

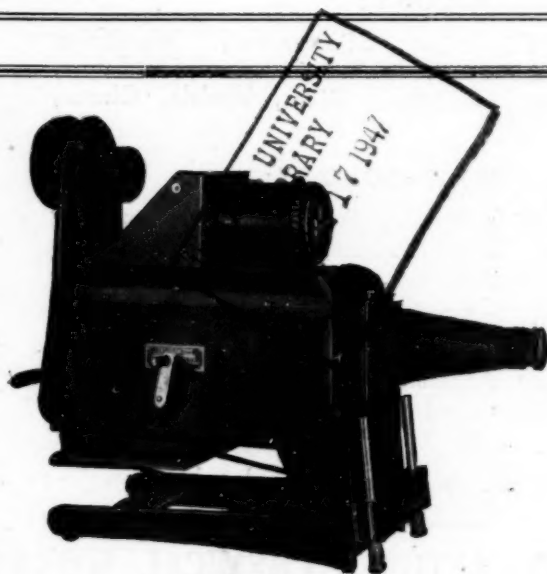
Current Science



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RICE RESEARCH

THE plenary session of the Rice Study Group, constituted under the auspices of the United Nations Food and Agricultural Organisation, was inaugurated by Dr. Rajendra Prasad at Trivandrum on the 16th of this month. This Group is the forerunner of the full Rice Conference to be held later this year. The function of the Group is reported to be limited to reviewing the rice problems of the countries in South-East Asia and recommending steps to secure increased production and arrange for timely and proper distribution of rice to the countries in need. The Group's report will be submitted to the next annual conference of the UNFAO.

Dr. Rajendra Prasad rightly stressed in his opening address the necessity for increasing the production of the commodity, and appealed to one and all to put forth the best effort in this direction. It appears to us, however, that if the Group confines itself merely to the problems of production and distribution the scope and utility of the Rice Conference will be unwarrantably limited. For among the rice-producing countries—India, China, Japan, Siam, Burma, Indonesia—there are as many countries that have an exportable surplus as those that suffer from a shortage. And the bottle-neck of transport which has upset the rice economy of all these countries can only be temporary. But this is not to belittle the gravity of the situation with

regard to rice shortage. We have suffered bitterly during the war, and still continue to suffer for our neglect in the matter of self-sufficiency of this staple article of diet in South India and Bengal. And if a similar calamity is to be averted we can lose no time in making up the deficit.

The deficit in India is of the order of about 2 million tons a year which must be made up, not by depending on imports, but both by intensive and extensive cultivation. The average yield of this crop in India is perhaps the lowest in the world, with twice the yield in China, three times in Japan and five times in Italy. More alarming still is the steady fall in the average as well as the total yield of rice which, when juxtaposed with a growing population, cannot but lead to acute shortage. An average yield in 1934 of 28.5 bushels per acre has diminished to 26.2 in 1939, and to 22.7 in 1941. Among the obvious causes for such a fall are the wasteful exhaustion of the soil and the primitive technique of agriculture, both of which brook no delay in being remedied. The indigenous manufacture of artificial manures and agricultural implements, and the systematic exploitation of town wastes for manure in the form of compost and purified sewage must go a long way in solving the critical problem of manure shortage.

What we should, however, like to emphasise is the indispensable need for long-term basic research on Rice. Unfortunately rice has received very little attention at the hands of the scientists compared to wheat, the staple food of the West. Wheat has been studied not merely from the agricultural but also from the genetical, biochemical and nutritional points of view. Thus a number of useful mutants like short-term and winter wheat, pest and rust-resisting wheat, whole meal and enriched flours have been evolved; and the wheat plant itself has formed the subject of extensive studies on plant nutrition and plant pathology. But with regard to rice, except for some work in Japan, investigations on rice and rice plant still remain to be studied. The paucity of knowledge in this field is reflected, in a way, in the scarcity of books and monographs on the subject.

Of the 2,000 and odd varieties of rice more than 700 are grown commercially in India. These differ, as is well known, not only in colour, flavour, shape and taste, but in their average yields per acre, cooking quality and digestibility. What is perhaps less known is that their chemical composition, vitamin content and nutritive value are also different. Some types, like the hill rice, thrive only on rain water, while others require a continuous supply up to a stage of development. A few are short-term crops while the rest are mostly long-term. The resistance to disease and pests also differs with the species. These characteristics are naturally genetical, and have to be studied from that angle, if we are to ultimately evolve mutants "to order". And the rice plant nutrition itself forms a wide and fertile field for research.

An important aspect of applied rice research which is yet to receive due attention is the

utilisation and commercial exploitation of the by-products of the rice industry. The straw, which is not normally fed to milch cattle, could be processed with weak alkali or otherwise in order to render it innocuous and useful for milking animals. The husk, apart from its low fuel value, could be more usefully exploited for the production of activated charcoals, furfural and other products. The rice-bran provides a rich source for processing vitamin concentrates of the B group. Successful exploitation of these by-products will not only lead to the establishment of a prosperous chemurgical industry but also help to subsidise the farmer and reduce the cost of rice for the consumer.

We hope the Rice Research Institute, which is now being organised at Cuttack by the Government of India, will be conceived on a scale comprehensive enough to include both the fundamental and applied aspects of the rice problem. In view of the importance of the subject to more than 150 million people in the country, and the wide variety and urgency of the problems, it is worth contemplating the establishment of a number of regional experimental stations in rice-growing areas. For the South, Coimbatore, where pioneering work has been carried out in this branch as in sugarcane, offers excellent possibilities for starting one of these research stations. With experimental stations dotted over the wide rice-producing areas, intensive research could be carried out on a scale liberal enough to yield quick and practical results which will help in averting crises similar to those we are facing to-day. We trust the Government and the rice-producing interests will sufficiently realise the importance of long-term basic research in solving the manifold problems of rice research.

EDITORIAL NOTES

SCIENTIFIC MAN-POWER COMMITTEE

THE institution of the Committee on Scientific Man-Power by the Government of India is a necessary corollary of the post-war plans of intensive industrialisation of the country and the training of the scientific personnel in India and abroad. The Committee is entrusted with the task, not only of assessing the long-range requirements for scientific and technical manpower but of utilising to best advantage the available skill in the country. In the last issue we discussed at length the former aspect of the question. The latter part is of immediate, and perhaps of crucial importance, and involves careful stock-taking of scientific talent scattered in various walks of life.

It is well known that a large number of bright science students have had to enter, till very recently, professions on which the specialised training they had received at the universities are thrown away. Only a small fraction indeed of the science graduates are still following a connected profession either in tutorial or technical capacity. If, therefore, all the trained men could be salvaged we might not really be so hard up for scientific man-power as it might at first appear. It might perhaps be argued that all the men, now languishing in non-scientific professions, cannot be mobilised for the purpose inasmuch as they have lost contact with science for varying long periods. But even those who have lately left the universities since the commencement of the war and who have entered the combatant and non-combatant

ranks in the army or various civilian jobs should make up a respectable number running into a few thousands. These men, young and fresh enough to benefit by refresher courses and special training, will surely come in handy to man the industries and laboratories that are to come into action in the shortest possible period.

In utilising the available man-power it would be of mutual advantage, to scientist and technician as well as to employer (private or Government), if a Scientific Man-Power Exchange be established by Government and all technical jobs are filled in through this agency. For it is unlikely that a mere maintenance of a register of scientific and technical personnel, as laid down in the terms of reference to the Committee, will be of much benefit to either party. We expect the Scientific Man-Power Committee will go into these questions in detail in formulating their recommendations for the development and exploitation of scientific man-power in India.

PASTURALOGY

PASTURALOGY concerns itself with the various aspects of pasture propagation and maintenance. The publications of the British Grassland Society is an urgent reminder of the necessity and importance of developing this branch of agricultural science in India, and its proceedings bring into relief the gross neglect of the technique of Pasture-growing in this country.

In Great Britain, America, Sweden and Denmark, intensive research is being carried on from the point of view of raising the grass yield, immunising it against pests either by breeding resistant strains or by chemical treatment, finding the types suitable for various soils and climates, increasing its nutritive value and numerous other economic and scientific possibilities. In India, on the other hand, except for a few ostentatious trials with Napier grass or Guinea grass or California grass little attention has been paid to the subject.

Unlike in other lands the Indian farmer does not believe in allotting lands exclusively for growing pasture or other cattle fodder. The straw that remains over after collecting the food-crops is the only standby for his cattle for a good part of the year. It is not surprising, therefore, that Indian cattle are notoriously

poor yielders. And this is due in no small part to the total neglect of pastoralogy.

In this country for each big village or a number of small ones a patch of land is allotted as common pasture for cattle. There is no ploughing nor sowing nor weeding of this land. The little grass that grows after the rains is soon grazed even as it grows, and for the major part of the year there is no pasture at all. The animals are given no change of grassland from one end of the year to the other, nor is there a rotation of crop in this common patch.

Thus the cumulative effect of such a policy has been that about 400,000 acres of land allotted for cattle in villages are being run to waste at a time when we can ill-afford to spare a single acre of cultivable land. With the gross paucity of dairy products facing the growing population it is needless to emphasise that all this land, and if necessary more, should be exploited in a way that would yield the highest economic returns.

Had we paid sufficient attention to pastoralogy we should not have been now driven to the desperate necessity of seeking inferior substitutes for milk and milk products in the form of vegetable milks and vegetable fats. Elsewhere it has been shown, for instance, that the weight promotion and milk yield is about 30 per cent. less per acre of permanent pasture than with pasture wherein rotation of crops is practised. It is also known that certain types of soils are fitted for the growth of only certain types of grasses. Evaluation of the economic worth of various types of grasses and pastures by way of the grazing animal is now being increasingly recognised as a rational method. These findings of pasture research indicate the concrete benefits we could derive by putting them into practice and working out for ourselves methods of cultivation and utilisation of grasslands suited to our climes.

If we are, therefore, in earnest about increasing the yield of milk and milk products and raising the level of consumption we cannot pay too much attention to this aspect of the dairy industry. While the Indian Council of Agricultural Research could actively sponsor intensive research into pastoralogy, the State must always be on the alert to translate the outcome of such research by proper publicity, education through rural exhibitions and demonstrations, and if necessary, by subsidisation and legislation.

ALL-INDIA COUNCIL FOR TECHNICAL EDUCATION

THE Mysore Government have invited the All-India Council for Technical Education to hold their next meeting in Bangalore. This invitation has been accepted and the Chairman of the Council, Mr. N. R. Sarkar, has fixed May 29 and 30, 1947, for the meeting.

The Council will consider, among other matters,

- (i) a preliminary report on survey of technical institutions in the country;
- (ii) reports of the Visiting Committees ap-

pointed by the Co-ordinating Committee of the Council to visit some of the important technical institutions in the country and to make recommendations for their improvement;

- (iii) the question of formation of the Regional Committees of the All-India Council for Technical Education; and
- (iv) the location of the proposed Higher Technical Institutions for the North and the South.

ON FRACTIONAL REPLICATION OF THE GENERAL SYMMETRICAL FACTORIAL DESIGN.

By K. KISHEN

(Statistician, Department of Agriculture, U.P., Lucknow)

FACTORIAL designs have now come to be extensively used for testing in a single experiment the effect of a number of interacting sets of factors. When, however, the number of sets of factors and/or the number of levels of each set of factors is large, there result a great number of treatment combinations. In such cases, even a single replication necessitates the use of large quantities of experimental material, the availability of which may be beyond the resources of the experimenter. It, therefore, becomes necessary to resort to the device of fractional replication which enables a factorial experiment to be carried out with only a fraction of the experimental units required for a complete replication. The basic principles of this theory have been developed in a recent paper by Finney,¹ who has, however, restricted himself to factorial arrangements p^n , where p is a prime number. It is the purpose of this note to show that, with the help of the geometrical theory of confounding given earlier by Bose and Kishen,² Finney's theory can be easily extended to the general symmetrical factorial arrangement s^m , where $s = p^n$, p being a prime positive integer and n any positive integer.

Bose and Kishen² have, by representing a treatment combination in an s^m factorial arrangement by a finite point of the associated m -dimensional projective geometry PG(m, s) constructed from the Galois field GF(s), established a (1, 1) correspondence between the s^m treatment combinations and the s^m points of the Euclidean geometry EG(m, s), which is a portion of PG(m, s). It has been demonstrated by Carmichael that the elements of the Abelian group of order s^m and type (1, 1, ..., 1) afford concrete representations of the EG(m, s). Thus, the correspondence of the s^m factorial design to the Abelian group of order s^m and type (1, 1, ..., 1) follows.

The treatment combinations in an s^m factorial arrangement may be represented by symbols $a_1^{\beta_1} a_2^{\beta_2} \dots a_m^{\beta_m}$, where $\beta_1, \beta_2, \dots, \beta_m$ take only the values 0, 1, 2, ..., $s-1$. If now 0, 1, 2, ..., $s-1$ are taken to denote the s elements $a_0 = 0, a_1, a_2, \dots, a_{s-1}$ respectively of GF(s), it would appear that these symbols form an Abelian group of order s^m and type (1, 1, ..., 1). It may be remarked here that there are different ways of identifying a_1, a_2, \dots, a_{s-1} with the $s-1$ non-zero elements of GF(s) when expressed in the standard form. In the case $n = 1$, i.e. when s is a prime number p , the identification we adopt is to take a_i equal to the residue class (i), modulo p . In the case when $n > 1$, i.e. when s is a power of a prime higher than the first, we take a_i equal to the residue class modulo $f(x)$ of the polynomial x^{i-1} , where $f(x)$ is a specified minimum function and the class with standard representative x is a primitive element of GF(s). The Abelian group of main effects and interactions,

which is isomorphic to the group of treatment combinations, is then represented by the sym-

bols $A_1^{\beta_1} A_2^{\beta_2} \dots A_m^{\beta_m}$, where $\beta_1, \beta_2, \dots, \beta_m$ take only the values 0, 1, 2, ..., $s-1$, these being the s elements of GF(s). Two elements $a_1^{\beta_1} a_2^{\beta_2} \dots a_m^{\beta_m}$ and $a_1^{\beta'_1} a_2^{\beta'_2} \dots a_m^{\beta'_m}$ of the treatment group will be defined to be orthogonal if $\sum \beta_i \beta'_i = 0$ in GF(s). Similarly, two elements $a_1^{\beta_1} a_2^{\beta_2} \dots a_m^{\beta_m}$ and $A_1^{\beta_1} A_2^{\beta_2} \dots$

$A_m^{\beta_m}$, the first of the treatment group and the second of the effect group, will be termed orthogonal if $\sum \beta_i \beta'_i = 0$ in GF(s). It would appear that if a treatment subgroup of order s^{m-k} is selected, the complete orthogonal effect subgroup is of order s^k .

The correspondence between effect subgroups and parallel pencils of $(m-1)$ -flats representing main effects and interactions follows readily from Bose and Kishen's theory. Thus, the pencil $x_i = a_j$ ($j = 0, 1, \dots, s-1$) of s parallel finite $(m-1)$ -flats representing the $s-1$ degrees of freedom for the main effect A_i corresponds to the effect subgroup $I, A_i, A_i^2, \dots, A_i^{(s-1)}$ of order s , and the complete orthogonal treatment subgroup of order s^{m-1} is given by the s^{m-1} treatment combinations corresponding to the s^{m-1} finite points lying on $x_i = 0$.

In general, the $s-1$ degrees of freedom for the k -factor interaction among the i_1 -th, i_2 -th, ..., and i_k -th factors represented by the pencil

$$x_{i_1} + a_j x_{i_2} + a_j^2 x_{i_3} + \dots + a_j^{k-1} x_{i_k}$$

$= a_j$, (j_2, \dots, j_k fixed; $r = 0, 1, \dots, s-1$) correspond to the effect subgroup of order s given by

$$I, A_{i_1}^{j_1} A_{i_2}^{j_2} A_{i_3}^{j_3} \dots A_{i_k}^{j_k}, A_{i_1}^{2j_1} A_{i_2}^{2j_2} \dots A_{i_k}^{2j_k}, \dots, A_{i_1}^{(s-1)j_1} A_{i_2}^{(s-1)j_2} \dots A_{i_k}^{(s-1)j_k},$$

where t_j ($t = 1, \dots, s-1$; $p = 2, \dots, k$) stands for the product of these two numbers in GF(s). The complete orthogonal treatment subgroup of order s^{m-1} is given by the treatment combinations corresponding to the s^{m-1} finite points lying on the $(m-1)$ -flat $x_{i_1} + a_j x_{i_2} + \dots + a_j^{k-1} x_{i_k} = 0$. Giving to j_2, \dots, j_k the values 1, 2, ..., $s-1$, we obtain all the $(s-1)^{k-1}$ pencils corresponding to the k -factor interaction. There are, therefore, $(s-1)^{k-1}$ effect subgroups of order s containing only the symbols $A_{i_1}, A_{i_2}, \dots, A_{i_k}$, but no others, which correspond to the $(s-1)^k$ degrees of freedom for the interaction $A_{i_1} A_{i_2} \dots A_{i_k}$.

It would appear from the above that each $(m-2)$ -flat in the $(m-1)$ -flat at infinity is the vertex of a parallel pencil of s $(m-1)$ -flats, which corresponds to an effect subgroup of order s . It is, therefore, appropriate to speak of an effect subgroup of order s as corresponding to an $(m-2)$ -flat at infinity. In general, an effect subgroup of order s^k would corres-

pond to an $(m-k-1)$ -flat at infinity, and the complete orthogonal treatment subgroup of order s^{m-k} can be readily written down, as explained above, from the equations to the k pencils of $(m-1)$ -flats of which the k independent $(m-2)$ -flats at infinity, having the $(m-k-1)$ -flat at infinity as their common intersection, are the vertices. In fact, the effect subgroup of order s^k would be obtained by taking the product of the k effect subgroups, each of order s , corresponding to the k independent $(m-2)$ -flats at infinity. If any effect subgroup of order s^k is taken as an alias subgroup, and all its elements set equal to the identity, the complete orthogonal treatment subgroup comprises a set of s^{m-k} treatment combinations appropriate for an arrangement in $1/s^k$ replicate. Each effect has then s^k aliases which are obtained by multiplication of one of its names by elements of the alias subgroup. In terms of parallel pencils of $s(m-1)$ -flats, each corresponding to $s-1$ degrees of freedom for a main effect or interaction, it would follow that the alias subgroup of pencils will consist of $s^{k-1} + s^{k-2} + \dots + s^2 + s + 1$ pencils, and the remaining $s^k (s^{m-k-1} + s^{m-k-2} + \dots + s^2 + s + 1)$ pencils are divisible into $s^{m-k-1} + s^{m-k-2} + \dots + s^2 + s + 1$ alias sets of pencils, each set containing s^k pencils.

As an illustrative example, let us consider a 4^4 design in $1/4^2$ replicate. Then one such design is obtained by taking the five pencils of 3-flats, viz. $x+2y+2z=0, 1, 2, 3; y+2z+2w=0, 1, 2, 3; x+3y+2w=0, 1, 2, 3; x+z+3w=0, 1, 2, 3$; and $x+y+3z+w=0, 1, 2, 3$, where 0, 1, 2, 3 denote respectively the elements a, a^2, a^3, a^4 of $GF(2^2)$, as the alias subgroup of pencils, to which corresponds the alias subgroup of order 16 given by

$I, AB^2C^2, A^2B^2C^2, A^2BC, BC^2D^2, B^2C^2D^2, B^2CD, AB^2D^2, A^2BD^2, A^2B^2D, ACD^3, A^2C^2D, A^2C^2D^2, ABC^2D, A^2B^2CD^2, A^2B^2C^2D^2$.

The complete orthogonal treatment subgroup to be used is

$1, ac^2d^2, a^2cd, a^2c^2d^2, bcd^2, abc^2d, a^2bd^2, a^2bc^2, b^2c^2d^2, a^2b^2c, a^2b^2c^2d^2, a^2b^2d, b^2c^2d, ab^2d^2, a^2b^2c^2, a^2b^2cd^2$.

which is obtained by taking the 16 treatment combinations corresponding to the 16 points lying on the 2-flat given by the equations

$$x+2y+2z=0 \text{ and } y+2z+2w=0.$$

Here the alias subgroup of pencils consists of the above 5 pencils, and the remaining $4^2(4+1)$ pencils of 3-flats are divisible into 5 alias sets of pencils, each set containing 4^2 pencils. It would be observed that the $1/4^2$ replicate of a 4^4 design gives main effects and two-factor interactions, or pairs of two-factor interactions, in some alias sets, and cannot, therefore, be considered to be of practical value unless two-factor interactions are ignored as of no importance.

For full details, the interested reader is referred to the author's paper on the subject to be published shortly elsewhere.

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ABNORMALLY DRY AND WET WESTERN DISTURBANCES OVER NORTH INDIA

By S. L. MALURKAR

(Poona 5)

WESTERN disturbances which produce rain in winter months in N.W. India are of great importance in agriculture, particularly for wheat in the Punjab. Some of the western disturbances give well-disturbed and abundant rain over the area, while others pass away without giving appreciable rain or even go dry. The obvious mode of explanation of the difference, by the insufficiency of moisture supply, begs the question to a certain extent. Upper air circulations due to the two western disturbances may at first sight appear to be similar (particularly when the extent of the weather charts is limited); but the resulting effects are widely different. A criterion was arrived at and used by the author for help in furnishing medium-range forecasts to agriculturists and aviators who need short-range forecasts.¹

Western disturbances over India are due to the passage of complex low pressure areas or waves over North India under the influence of extra-tropical depressions. These areas, if dealt as such, are not easily understandable either as regards their effects or their motion. A simple method would be to treat the complex

low pressure area as composed of a number of simple low pressure areas or successive secondaries with distinct identity and circulation.² All these secondary low pressure areas travel in an almost east-northeasterly direction, and in the course of the travel one or more of them may fill up or sometimes intensify. The upper air circulation and rain are due to the combined or resulting effect of the various secondaries at a place. When a primary extra-tropical cyclone passes at a higher latitude, the secondaries form at certain places, which are favoured by orography and the distribution of land and sea.³ Some of these favoured places (with reference to India) are: the coastal region west of the Nile river; upper of south Egypt; Sudan and Red Sea; Gulf of Aden and the Oman Peninsula; North Arabian Sea off Mekran; East Arabian Sea off Kathiawar and Konkan; and occasionally the head of the Bay of Bengal. The lesser component of earth's rotation in the tropics compared with the higher latitudes probably needs that the secondaries form only when favoured by orography. The secondaries that develop in lower latitudes

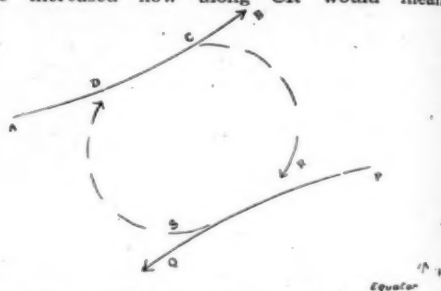
(Sudan, Red Sea, off Mekran or off Konkan) affect India, and lack of rain in N.W. India would mean that the particular secondaries were not fully developed.

In the first three or four days of April 1944, a very active western disturbance passed over N.W. India and the rain it produced resembled a day when the S.W. monsoon extends to N.W. India. But it dried up in the course of the next couple of days and hardly showed the activity in N.E. India which one expected. From the clouding and other features, the disturbance could be located in Deltaic China on the 8th. In South Indian Ocean east of Madagascar, a deep depression was found on 7th, and it had moved from the east. Similarly in January 1945, the rainfall which was fairly good in N.W. India during the first ten days of the month fell off rapidly, and simultaneously a depression could be located in S. Indian Ocean. Due to depressions in S. Indian Ocean which formed in quick succession and moved westwards, there was a dry spell over N.W. India during the greater part of the next four or five weeks. It was, therefore, deduced that western disturbances were not quite active or even passed dry when there was a deep depression south of the equator (but not too far south and not widely separated in longitude)¹ or when the seasonal low pressure area south of the equator was more marked than usual. A tentative explanation of the mechanism involved in drying up the northern disturbance based on divergence and subsidence was given.⁴ The dynamics of the process can now be given in relation to other known phenomena.

Just north of the equator, in the lower levels of the atmosphere, there is an easterly or east-northeasterly flow of air (N.E. Trades). At higher latitudes, there is a westerly or west-southwesterly stream. (The higher levels are not immediately under consideration.) The easterly winds become stronger when fresh 'pulses' or low pressure areas travel from the east and cross the equator to feed a southern cyclonic storm or a depression. The westerly winds at higher latitudes feed into the western disturbances or their secondaries as tropical air (T) and may strengthen (see Fig. PQ easterly, AB west-southwesterly). When there is such a juxtaposition in the northern hemisphere—an easterly at a lower latitude and a westerly at a higher latitude—the high pressure area in between divides itself into cells of high pressure, or a series of anticyclones. When there is no disturbance to the north or south of it, the anticyclone may be described as stationary in intensity and in approximate position (CRSD). The subsidence would be small and the air in it generally stable.

If the wind stream PQ becomes stronger due to a cyclonic storm south of the equator and the passage of 'pulses' from north to the southern hemisphere, the anticyclone becomes a developing or an increasing one. There would be a tendency for an increased flow of air along CR. The flow along SD may also be slightly increased, but as the passage of 'pulses' is almost explosive across the equator (shown by the squalls and thunderstorms) this point

may be considered later. For the stream AB, the increased flow along CR would mean



divergence, one an actual due to separation from the original stream and the other one due to descent in latitude. Due to these two effects, the air gets very stable. As the rate of subsidence is greater in a developing anticyclone than in a stationary one as shown by Napier Shaw, the air in the anticyclone would be greatly stabilised. If there be a secondary of a western disturbance to which the stream AB is feeding, both the currents CB and CR speed up and may result in greater divergence. When N.E. Trades get stronger due to the fact that 'pulses' are feeding into a southern tropical cyclonic storm or depression or due to an intensification of the southern monsoon low, the air mass (along AB) that would normally have gone to feed the secondary of a western disturbance is attaining great stability and produces little weather in the shape of precipitation. If the southern depression is too far south of the equator (when no 'pulses' feed it from the north), or when it is widely separated longitudinally, the effect on the particular anticyclonic cell would be less, and it can be assumed that the western disturbance is not being affected from the southern hemisphere.

Regarding subsidence on a large scale in Peninsular India, the surface observations at the higher hill stations (Dodda-betta, Coonoor, Kodaikanal) show it by the very low humidities observed on some winter days there.⁵ Hahn⁶ has given instances of very low humidity at hill stations in Dutch East Indies (Sumatra, Java, etc.). With the help of Radiosonde observations in these days, it is possible to actually notice subsidence at higher levels of the atmosphere over a wider area. There would not be any definite time sequence in the subsidence observation. The dot diagram⁵ connecting the extreme dryness at Kodaikanal and the inversion layer at Poona (found by sounding balloons) is almost contemporaneous.

The sudden clearing up of the sky in Central parts of India when there is a depression south of the equator is so striking that a forecaster with a big chart can hardly escape noticing it.

Regarding the increased flow along SD due to the developing anticyclonic cell, though there is divergence in the easterly stream, there is also a latitudinal convergence as it is gaining in latitude. It is likely that some weather can be expected to the west of the

anticyclonic cell. This may perhaps account for some of the rain in the extreme south Peninsula when a southern depression is passing fairly near the equator.⁷

The 'pulses' or low pressure areas that travel from the east to feed the southern depression are not entirely unaffected by the secondary of the western disturbances over India. The western disturbance might 'pull' the low pressure area towards it and delay and occasionally prevent its crossing into the southern hemisphere. Whether the 'pulse' or low pressure area would be pulled towards the low of the western disturbance or to the southern depression depends very much on the relative intensities and positions of the tropical and extra-tropical depressions. The non-crossing of the 'pulse' to the southern hemisphere would create a 'break' in the monsoon there, weaken the depression and might sometimes kill or allow the depression to recurve.⁸

In the event of the western disturbance 'pulling' the low pressure area from the east to west even temporarily, the anticyclonic cell would once again be developing. The stream QSD which leaves the easterlies PQ is gaining in latitude and sometimes would cause weather; to the west of the anticyclonic cell there could be weather due to latitudinal convergence. But if it happens that the low pressure area or 'pulse' is not allowed to cross the equator at all, then there would be a general flow of the stream PQ along SD. In such an event, the resulting convergence would be more pronounced and the rainfall due to the secondary of the particular western disturbance which gets this feed would be greater than usual.⁹ Such a contingency (the 'pulse' or the low pressure area not crossing to the southern hemisphere) can arise if the southern depression was filling up or recurved to an easterly direction.

On the other side of the developing anticyclonic cell CR, there would again be stability in the air along the region and the easterly side would be dry. (Rao Bahadur M. G. Subramanyam used to mention a belief held in Rajputana that there would be no rain in North Rajputana in winter so long as there was rain in S.E. Madras, and it is likely that the above is an explanation.)

Hence it follows:

(1) When there is a cyclonic storm in the

South Indian Ocean moving from east to west and it is expected to continue strong or intensify and expected to retain a westward motion, it is safe to tone down the amount of rain due to a western disturbance in Upper India (the longitudinal separation must not be too much between the cyclonic storm and the western disturbance).

(2) When the southern cyclonic storm in the S. Indian Ocean is expected to fill up or recurve towards an easterly direction and the 'pulses' or low pressure areas from the east continue strong north of the equator, the western disturbance gives more rain than usual.

A similar criteria can be used at other places. When the N.E. Trades (in the northern hemisphere) which have had a sea travel continue to be strong, the extra-tropical depression just above that latitude would be more active or less active according as the N.E. Trades fed into or away from the depression. The extreme case of the situation is a recurved tropical cyclonic storm, which can give abundant rain or weather. The cyclonic storm recurves when the equatorial maritime air is cut off and the storm is guided by an extra-tropical depression in a higher latitude. In other words, the recurved depression can be considered as a secondary of the extra-tropical depression, which has had a good N.E. Trades feed. Such a criterion would be particularly useful in the Pacific Ocean.

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THE MILLS-NIXON EFFECT

By S. V. ANANTAKRISHNAN

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A GROUP of observations by Mills and Nixon²² on substitution in the aromatic part of hydrindene led them to postulate a "fixation" of the bonds. Since then several other instances of a similar nature have been reported by other workers.^{6,7,12,14} Both experimental and theoretical investigations have been reported and Rangaswami and Seshadri²⁶ have given a fairly comprehensive account of the experimental side,

The main lines on which the experimental investigations have proceeded make use of one or other substitution reaction in the aromatic part of a mixed system. In drawing conclusions from these observations, however, one cannot ignore the limitations of all interpretations based only on chemical reactions. This is clearly brought out by an analysis of the mechanism of the reactions that have been used. The principal reactions that have been

used are the following: (1) Bromination, (2) Nitration, (3) Ozonolysis, (4) The Claisen Rearrangement, (5) The Fries Reaction, (6) The Gattermann Reaction, (7) Coupling with Diazonium Salts and (8) Condensations in the presence of Aluminium Chloride.

The results of the experimental investigations are summarised in Table I.

obvious that the configuration of the aromatic system in the presence of a polarising field as at the instant of reaction cannot be the same in the absence of such a field.

3. The mechanism of ozonolysis in the case of poly-enes is still far from satisfactorily established. Results based on this reaction cannot, therefore, be considered unequivocal

TABLE I
Experimental Evidence of Fixation

Ring system	Reaction used	Results	Reference
Benzene	3, 4, 5, 8	Bond fixation	Levine and Cole ¹⁷ Baker ⁶
Naphthalene and Tetralin	4, 7 Halogen reactivity Skraup Synthesis	Evidence both for and against fixation of bonds	Baker and Lothian ⁷ Claisen ¹⁰ Fries ¹⁴ Fieser and Lothrop ¹² Marckwald ²¹ vanBraun and Grüber ³²
Hydrindene	1, 2, 3, 7	ditto	Borsche and Rodenstein ⁹ Arnold and Evans ⁴ Fieser ¹¹ Macleish and Campbell ²⁰ Sandin and Evans ²⁸
Fluorene	1, 2, 4, 5	Little fixation of bonds	Anantakrishnan & Hughes ³ Bergmann and Berlin ⁸ Lothrop ¹⁹
Coumarins and Chromones	4, 5	Bond fixation	Baker and Lothian ⁷ Limaye
Anthracene	1, 7	Evidence both for and against bond fixation	Fries ¹⁴
Phenanthrene	4, 7	Bond fixation	Fieser and Lothrop ¹² Fieser, Young and Newman ¹³ Smith ³¹

Taking the reactions in the order given, the position can be summarised as follows:—

1. The essential feature of bromination is that the reagent is the polarised molecule which behaves as an electrophilic reagent and a bromine atom is transferred as a positive ion with a sextet of electrons. The transition state even in the simple case of benzene involves contributions by seven valence bond structures.³³ A study of the reaction at higher temperatures have shown that the relative amounts of isomeric substitution products vary to a considerable extent.³⁴ The peroxide effect is another complication in polynuclear systems.²³ Any conclusions based on this reaction can at best be an approximation representing the position under the conditions of the experiment.

2. The usual experimental conditions for nitration conform to the initiation of attack by an electrophilic reagent and the conditions for the influence of groups should be analogous to the first reaction. The principal mechanisms that have been postulated for this reaction involve either an addition of nitric acid to the double bond in the aromatic part²⁵ or initiation of attack by the nitronium ion NO_2^+ .¹⁵ Kinetic studies as well as the physical properties of solutions of nitric acid under the usual conditions for the reaction are quite consistent with attack by the nitronium ion. The transition state here should involve an even more complex system than bromination. Further, it is

evidence for bond fixation.

4. The migrations of groups to the ortho-position have been used to a considerable extent. The Claisen rearrangement appears to have been used not a little because of the apparent absence of catalytic influences. The undesirable side reactions in the case of ethers of higher boiling point and the better yields with reduced polymerisation during rearrangement when basic solvents are used indicate the complex nature of the problem. The distinct differences noticeable between rearrangements involving the allyl group and of alkyl groups bring out the special features of the allyl group which should be taken into account in using this reaction as evidence for bond-fixation. The para rearrangement seems to require an intermolecular mechanism. Further investigation is clearly needed before one can consider the interpretations as a correct picture. Subject to this limitation, the reaction gives us an indication that bond-orders in the aromatic part of the mixed system or in a substituted benzene are probably not the same in the six-membered ring.

5. The Fries reaction differs from 4 in that the migrating group is an acyl, and definitely requires a catalyst. The relative unreliability of this reaction as a criterion for bond fixation is readily seen from the fact that the nature of the product is dependent on the structure of the ester, the temperature of the reaction, the solvent used and the proportion of the

catalyst used.¹ Existing data are inadequate in fixing a single mechanism; some of the mechanisms that have been proposed treat the reaction as an intermolecular one while others make it out to be an intramolecular one. The mechanistic uncertainty also reduces the value of this as a criterion for bond fixation.

6. The modified Gattermann reaction has been used in very few cases at best as a confirmatory test and with the meagre data no generalisation is possible.

7. Fieser and co-workers have used the coupling reaction with a number of compounds as a specific reaction for establishing bond fixation. If one can assume that Meyer's mechanism of coupling reactions of the diazonium compounds, is the correct one there is some justification in assuming Fieser's interpretation as a probable correct picture. The mechanism of these reactions has not been taken out of the field of controversy and it is necessary to examine if a different explanation of the observations is not possible. It should be stated, however, that of all the chemical evidence adduced in favour of the concept of bond-fixation this reaction is the one with the maximum degree of consistency.

8. These condensation reactions are of too complex a nature to be of much significance for diagnostic purposes at present.

In addition to these reactions physical measurements have also been pressed into service to elucidate the problem under discussion. These include dipole moments,³⁰ dissociation constants of acids,⁴ oxidation-reduction potentials⁵ and measurements of bond distances.¹⁶ The first three have been used essentially as methods of comparative study and the results have not turned out to be very conclusive. The measurement of bond distances has not been very helpful either and the values obtained have been generally against any fixation of the double bonds in a specified position.

Before discussing the experimental facts, it is necessary to consider the theoretical treatment of the problem. Two different approaches have been made, one by Pauling and Sutton²⁴ and the other by Longuet-Higgins and Coulson.¹⁸ Both treat only the specific example of hydrindene and the final results are quite different. The concept of Mills and Nixon²² that the angles between two single bonds in benzene are different from that between the two double bonds which formed the basis of their suggestion of bond fixation is to some extent at the background of the treatment by the earlier authors. In setting up the secular equation for the wave-functions, Pauling and Sutton ignore the excited structures and consider only the relative contribution of the Kekule forms, the matrix elements including the angle between the ortho-valencies and a bending force constant. The secular equation is solved by assuming that the value of the bending force constant for the C-C bond is the same as that of the C-H bond in HCN and a ratio of the coefficients of the two Kekule structures is calculated to be about 1.05. Using this value, the ratio of the rates of substitution in positions 4 and 6 in hydrindene is derived and the values of the yield are found to be in accord with the experimental observations of Mills. (*loc. cit.*).

Longuet-Higgins and Coulson treat the prob-

lem by the method of molecular orbitals. A fundamental difference in their treatment of the problem lies in the assumptions in evaluating valence angles and bond forces that all the aromatic bonds are of one fixed length, all other carbon-carbon bonds are of a different fixed length, and the energy to form the valence angle at a trigonal carbon is the same whether the linked atoms are carbon or hydrogen. The total energy of the electrons is calculated by the method of Lennard Jones and the resonance integral is obtained as a function of the bond lengths and the force constants of the single and double carbon-carbon bonds. In the absence of standard values of the angular deformation constants needed in the calculations of the stresses involved, the value has been calculated assuming the assignment of the frequency in the propane molecule and treating the system as a non-linear triatomic molecule XY₂. In a similar manner, the deformation constant for a trigonal carbon has been obtained by a comparison of the bending frequency of propane with that of propylene. A result of the analysis by these authors lead to the observation: "Hence we must abandon the idea that the 4-bond in hydrindene is of a higher order than the 3-bonds and look elsewhere for an explanation of the greater reactivity of the 6- than 4-position in hydroxy hydrindene."

It is interesting to recall here the difficulty in reconciling the electron diffraction results of Kossiakoff and Springall¹⁶ with the dipole moment observations of Sidgwick and Springall. It has been found necessary to abandon the hypothesis of the additivity of bond moments and to postulate additional resonance states in order to account for the apparent discrepancies.

Before we can take up the question of a possible explanation for the experimental observations, attention should also be drawn to Baker's observations on chelation which have played not an insignificant part on this subject of bond fixation. The strength of this evidence depends essentially on the unconscious assumption of a covalency of two for hydrogen. When one recognises that the hydrogen bond whether intermolecular or intramolecular is essentially an ionic bond and a chelate ring can be considered as a mobile electron system, this turns out to be of doubtful value in treating any bond system of the type under consideration as a static system. The question again becomes quite an open one.

It is possible to account for the different observations without postulating any bond fixation. Attention has been drawn early in this account to the limitations of each of the reactions that have been used. Any explanation must take into account the nature of the reaction and whether one approaches the problem from the collision theory or the transition state theory, the factors of diagnostic interest in the rate constant equation are the frequency factor and the energy of activation.

The paucity of accurate kinetic data precludes any quantitative analysis but an approximate computation may none-the-less be attempted. The substitution reactions that have been used may be expected to require an energy of activation of the order of 20 kilocalories, the values being different for the

different positions—ortho-, meta-, para-, etc. It can be shown that even a small difference in the activation energy of 5 per cent. will lead to difference in rate of substitution of more than a power of 10. This in turn will be reflected in the yield of the product. Combined with the normal errors in the estimates of yield in an average preparation of an organic compound, secondary products of a side reaction can be readily missed if the proportion is small, as will be the case here. One can legitimately conclude, then, that the experimental observations and theoretical requirements of the systems of the type of hydrindene do not require a static picture of the type postulated by Mills and Nixon. The fusion of a saturated ring to an aromatic system need not necessarily involve any appreciable change in the bond angles or in the bond distance of the common bond. The relative ease of substitution can be readily accounted for by a consideration of the polarising force of the substituents as well as the reactant molecules. There is no doubt that further investigation and accurate data are needed for a full appreciation of the problem.

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Note.—The cost of printing this contribution has been defrayed by a generous grant from the Rockefeller Foundation for the publication of results of scientific work made to us through the kindness of the National Institute of Sciences, India.—Ed.

GEOMAGNETIC STORMS

GEOMAGNETIC activity during the quarter January-March 1947 was on the increase as compared with the previous quarter. Some details of the geomagnetic disturbances recorded at the Alibagh Magnetic Observatory during the quarter January-March 1947 are given in the following table in which t_0 and t represent the time (I.S.T.) of commencement of the disturb-

ance and its intense phase respectively, and T the duration of the intense phase expressed in hours. The ranges in the three different elements (D , H and V) of the earth's magnetic field have also been given, D , in minutes of arc, H and V in γ where $1\gamma = 10^{-5}$ gauss. The maximum k -index recorded during the disturbances have also been given.

Date	t_0	t	T	Range			k_m	Nature of commencement
				D	H	V		
1947	h. m.	h. m.	hrs.	min.	γ	γ	.	
January, 16-17	8 57	8 57 on 16th	5½	5-8	153	58	6	Sudden
January, 24-27	About 10 00	10 21 on 25th	7	5-8	258	64	6	Gradual
February, 16-17	8 29	15 38 on 16th	9	5-1	366	88	8	Sudden
March, 2-3	9 29	13 45 on 2nd	7	7-8	434	77	8	Sudden
March, 8-9	About 11 30	11 30 on 8th	12	4-1	330	45	6	Gradual
March 15	14 12	14 12	8	4-6	199	35	6	Sudden

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NUTRITIONAL REQUIREMENTS OF A
SACCHAROMYCES Sp.? ISOLATED
FROM COCONUT TODDY

A SAMPLE of coconut toddy obtained from Ceylon was found to contain an unusually large-sized yeast. Attempts to isolate this organism on wort-agar proved unsuccessful. It, however, grew on a synthetic medium fortified with thiamin, riboflavin, pyridoxin, pantothen, niacin, biotin, inositol and *p*-amino-benzoic acid.

It was, therefore, of interest to determine the essential vitamin and other nutritive requirements. The big size of the cell ($15\mu \times 5\mu$) facilitated cytochemical investigation of the syndromes of avitaminosis.

Basal media with no vitamins were compounded with solutions of salts, citrate buffer (pH 4.6), ammonium sulphate (0.4 gm./100 ml) and glucose (5 gm./100 ml.). The all-vitamin media, those lacking a given vitamin or an essential amino-acid were compounded, 5 ml.

TABLE I
Yeast-Growth on Media With and Without Essential Nutrients

Media composition	Percentage of absorption	Average size of cell in microns	Remarks
Basal medium (no vitamins) ..	16	9.5 × 3	Vacuolated cells
B. M. with all Vitamins & amino acids ..	55	15.0 × 5	Granulated cells
Lacking thiamin ..	50	12.5 × 3	Thin cells
Lacking riboflavin ..	53	16.0 × 5	
Lacking pyridoxine ..	53	12.5 × 5	Highly vacuolated
Lacking calcium pantothenate ..	41	12.5 × 5	Cytoplasm thin
Lacking nicotinic acid ..	16	12.5 × 5	Few granules
Lacking <i>p</i> -amino-benzoic acid ..	53	10.0 × 3	Granulated cells
Lacking biotin ..	37	12.5 × 5	Refractive granules
Lacking inositol ..	24	12.5 × 5	Less of cytoplasm
Lacking choline ..	50	12.5 × 5	
Lacking <i>l</i> -aspartic acid ..	73	10.0 × 5	Large vacuoles
Lacking <i>l</i> -tryptophane ..	52	12.0 × 5	Thin cells
Lacking <i>l</i> -cystine ..	50	12.0 × 5	
Lacking <i>dl</i> -methionine ..	53	12.0 × 5	
With Lily liver extract ..	62	12.5 × 5	Granulated cells
With inositol, niacin, biotin and calcium pantothenate ..	53	12.0 × 5	Granulated cells

of each sterilised and distributed into sterile test-tubes (22 mm. \times 150 mm.), and inoculated with 0.5 ml. of a uniform yeast suspension of a 24-hour culture containing 0.4 mgm. of wet yeast per ml. The tubes were placed at a slant and incubated at 28° C. for 24 hours.

Turbidities representing growths were photoelectrically measured and expressed as the percentages of absorption (see Table I).

The results show that:—

(1) Nicotinic acid and inositol are the essential vitamins for the growth of the organism; biotin and pantothen are stimulatory. Lack of these vitamins result in vacuolation or in a poor differentiation of cells.

(2) Other vitamins exert little effect on growth. This is supported by the fact that the growth-rate on a basal medium fortified with only niacin, inositol, biotin and pantothen is as good as that on the all-vitamin medium.

(3) The microscopic appearance of the two cultures are similar showing that the four vitamins satisfy all the normal requirements of the organism.

(4) Liver extract which has given a significantly higher growth and induced a distinctive microscopic picture, appears to contain a growth factor or factors essential to the organism—vitamin or amino acid—other than those investigated.

(5) The adaptability of this yeast as a test organism for the microbiological assay of niacin and inositol is indicated.

Our sincere thanks are due to Sir J. C. Ghosh for his kind interest.

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SORAB P. MISTRY.
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Section of Fermentation Technology,
Indian Institute of Science,
Bangalore,
April 30, 1947.

MICROBIOLOGICAL ASSAY OF NIACIN WITH A SACCHAROMYCES Sp.? ISOLATED FROM COCONUT TODDY

THE vitamin requirements of this organism have been determined and the indispensability of niacin and inositol for its growth established.¹ It was of interest to examine the adaptability of the organism for the assay of niacin, and determine the range of concentration which could be estimated.

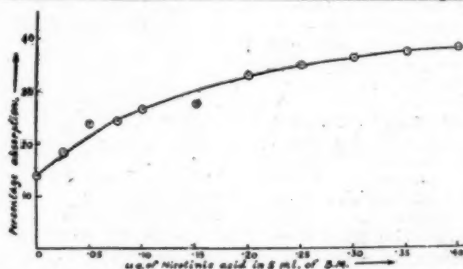
Basal media containing all vitamins but niacin were compounded. 100 ml. of the medium contained:—Glucose 5 gms., ammonium sulphate 0.4 gm., l-aspartic acid 10 mg., l-tryptophane 1.2 mg., l-cystine 4 mg., dl-methionine 4 mg., thiamin 80 μ g, riboflavin 80 μ g, pyridoxine 80 μ g, pantothen 80 μ g, p-amino-benzoic acid 80 μ g, biotin 100m μ g inositol 200 μ g, solution of salts 12.5 ml. and citrate buffer (pH 4.6) 10.0 ml.

Aliquots of the medium (2 ml.) were distributed into sterile tubes (22 mm. \times 150 mm.), graded amounts of niacin added and the volume made up to 4.5 ml. with sterile water. The tubes were inoculated with a washed and uniform suspension of the organism (previously grown on an all-vitamin medium for 24 hours)

and incubated for 24 hours at 28° C. Growths of the organism were photoelectrically measured and the results expressed as percentages of absorption (see Table I and Fig. 1).

Medium with μ g Niacin	0.0	0.025	0.05	0.075	0.1	0.15
Per cent. absorption	14.5	18.5	24.0	24.5	26.0	27.0

Medium with μ g Niacin	0.20	0.25	0.3	0.35	0.4	0.5
Per cent. absorption	32.5	34.5	36.0	37.0	37.5	38.5



It is concluded that (1) the organism is adaptable for the assay of niacin and (2) the assay-range lies between 0 and 0.04 μ g per ml., and this method appears to represent a more sensitive method of assay than others so far known.

Our grateful thanks are due to Sir J. C. Ghosh for his kind interest.

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April 30, 1947.

¹ Ramachandra Rao, Mistry and Sreenivasaya, *Curr. Sci.*, 1947, 16, 145.

PHYTOPHTHORA PALMIVORA BUTLER ON CYPHOMANDRA BETACEA SENDT. AND CARICA PAPAYA LINN.

Two isolates of *Phytophthora* were obtained from two independent sources, one from the stem of tree tomato (*Cyphomandra betacea* Sendt.) with a patch canker from the Fruit Station at Burliar at the foot of the Nilgiris, the other from a rotten hollow stem of a pawpaw tree in Coimbatore.

Both these isolates did not produce any oospores in pure culture even after three months although sporangia and chlamydospores were produced in abundance in old cultures. Therefore, they were grown in paired cultures with known plus and minus strains of *P. palmivora* available in the Government My-

Isolate with which the <i>C. betacea</i> and <i>Carica papaya</i> <i>Phytophthora</i> were grown in paired cultures	Plus strain					Minus strain			
	<i>Areca</i> , S. Kanara	<i>Areca</i> , Bombay	<i>Colocasia</i> , S. Kanara	<i>Tomato</i> , Coimbatore	<i>C. betacea</i> Burliar	<i>Ca. papaya</i> , Coimbatore	<i>H. eculi</i> , Coimbatore	<i>Spondias</i> , S. Kanara	<i>Areca</i> , Bombay
<i>Cyphomandra betacea</i> isolate	0	0	0	0	0	X	X	X	X
<i>Carica papaya</i> isolate	X	X	X	X	X	0	0	0	0

X — Oospores formed within four days; 0 — no oospores formed.

coligist's stock culture collection at Coimbatore. The results of these trials are set down below in a tabular form:

These results show that the *C. betacea* isolate is a plus strain of *P. palmivora* and the other a minus strain.

Mycology Section, M. S. BALAKRISHNAN,
Agriclutural Research Institute,
Coimbatore (S. India),
May 15, 1947.

ON THE ANALYSIS OF BLOOD-GROUP DATA OF PUNJABIES AND MALDIVIANS

KALRA¹ has examined the blood groups of 2,500 Punjabies at I.M.H., Rawalpindi, and of 211 Maldivians at Adder Atoll. This note gives the results of statistical analysis of the data collected by him.

Let p , q and r represent the true gene probabilities of the three allelomorphous genes A, B and O respectively, so that $p+q+r=1$. These true values for Punjabies and Maldivians are,

the blood-group data are in good agreement with Bernstein's genetical theory.

The maximum likelihood estimates of gene probabilities for Punjabies and Maldivians, along with their standard errors, are presented in the annexed table.

Column 3 of this table gives the estimated gene probabilities, Column 4 the corresponding variances and Column 5 the estimated gene probabilities and their standard errors, both multiplied by 100. It would appear from this table that the proportions of A and B genes in the case of Punjabies are significantly higher than in the case of Maldivians. However, the proportion of O genes for Punjabies is significantly lower than that for Maldivians.

Dept. of Agriculture, U.P.,
Lucknow,
April 25, 1947.

K. KISHEN.

1. Kalra, S. L., *Curr. Sci.*, 1947, 16, 92. 2. Stevens, W. L., *Ann. Eugenics*, 1938, 8, 362. 3. Bernstein, F., *Klin. Wschr.*, 1924, 3, 1495. 4. —, *Z. indukt. Abstamm.-u. Vererblicheit*, 1925, 37, 237.

Caste	Gene	Estimated Probability	Variance	Percentage and standard error
1	2	3	4	5
Punjabies	O	•5942048	$\times 10^{-8}$ 5•6601849	59•420 \pm 0•752%
	A	•1752423	3•1879764	17•524 \pm 0•565%
	B	•2305529	4•0625955	23•055 \pm 0•637%
Maldivians	O	•7653750	$\times 10^{-4}$ 4•58493	76•538 \pm 2•141%
	A	•1051228	2•35896	10•512 \pm 1•536%
	B	•1295022	2•86833	12•950 \pm 1•604%

however, unknown, and have, therefore, to be estimated from the samples examined by Kalra. The most efficient estimates of the true gene probabilities are readily obtained by the use of the method of maximum likelihood which has been discussed in full detail by Stevens.²

Using the maximum likelihood estimates of the true gene probabilities, the conformity of the blood-group data for Punjabies and Maldivians with the genetical theory advanced by Bernstein^{3,4} has been tested by applying the χ^2 -test with one degree of freedom. For Punjabies, $\chi^2 = 2.25722$ ($0.20 > P > 0.10$) and for Maldivians, $\chi^2 = 0.10361$ ($0.90 > P > 0.80$). Neither of these values is, therefore, significant at the customary 5 per cent. level of probability. Thus, for both Punjabies as well as Maldivians,

EFFECT OF CERTAIN FACTORS ON THE PULSE FREQUENCY OF A RELAXATION OSCILLATOR

An audio-pulse frequency oscillator working on the relaxation oscillations of a thermionic valve controlled by the constant 'CR' of the time circuit has manifold applications. The device is usually a condenser shunted by a high resistance suitably placed in the oscillator valve circuit. A number of arrangements have been described by many authors,^{*} but none seem to have paid much attention to the effect of other factors on the pulse frequency apart from the constant 'CR'. The object of the present communication is to give the effect of

two factors (a) the inclusion of a small inductance in the time circuit and (b) the filament current, on the pulse frequency.

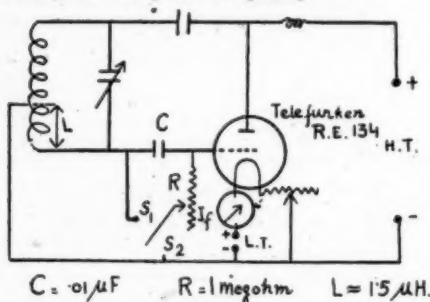


FIG. 1

The oscillator used for the investigation was a parallel fed Hartley Type one, suitable for short-wave range of 50 to 150 metres, the pulse generating device being a fixed condenser C of 0.01 M.F. capacity shunted by a variable carbon resistance having maximum value of one megohm. The switch in position S_1 shunts the condenser C by R directly, whereas in position S_2 , through small inductance L. Loosely coupled crystal wave-meter serves for the detection of pulses. The audio-frequency of the note was determined with the help of standard tuning forks and a sonometer. Throughout the investigation the carrier wave-length was maintained at a fixed value. Variation of pulse frequency 'f' with resistance R was studied for two different filament currents and the two positions S_1 and S_2 of the switch. However, the filament current cannot be changed much from the rated value without affecting the performance of the valve. Results are graphically shown in Fig. 2. The points marked as \odot correspond to the position S_1 , and that as \times to the position S_2 of the switch.

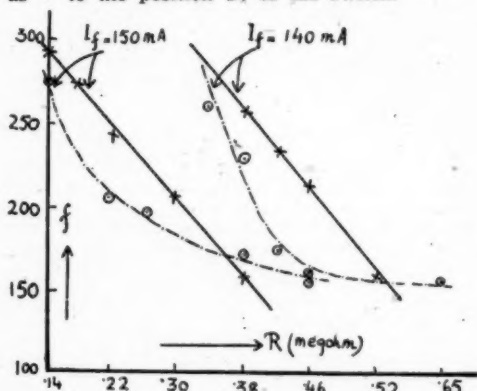


FIG. 2

It is seen from the graphs that if the usual method of directly shunting the condenser is used then the variation of pulse frequency 'f' with resistance R is non-linear. The effect of

inclusion of a small inductance in the time circuit is to make the variation linear.

The reduction of filament current has no effect on the range of pulse frequency which is 160 to 300 cycles in the present case; but higher values of resistance R are necessary to get the same range.

Department of Physics,
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Bikaner,
March 8, 1947.

V. L. TALEKAR.

- * 1. Appleton, Watt and Herd, *Proc. Roy. Soc.*, 1926, 111, 673. 2. Schafer and Gordall, *Proc. Inst. Rad. Eng.*, 1932, 20, 1131. 3. Morgen, *Rev. Sci. Inst.*, 1938, 9, 180. 4. Morin, *Compt. Rend.*, 1938, 205, 1590.

PARTITIONS OF AIR MASSES IN THE TROPICS, AND THE I.T.F.

THE Norwegian school of meteorologists expounded and developed the Polar-Front theory of extra-tropical cyclones. An active outbreak of cold polar air across this semi-permanent polar front led to the formation of the cyclones. The approximate positions of the semi-permanent Polar, Arctic and Antarctic fronts were given. An equally simple picture for a semi-permanent front given by the same school is the Inter-tropical-front (I.T.F.) representing the belt or region of convergence of the trade-winds from the two hemispheres. This line was represented as a broken line circling round the globe.¹ Willett has made the line a bit more continuous or unbroken.² It is very nearly the pressure equator. In Indian area, Willett has passed the line in summer through the seasonal low pressure area. But in the corresponding North American area, the line is kept away from the seasonal low, and drawn nearer the geographical equator. The behaviour of "Hurricanes" of West Indies must have been responsible for this change.

In India, the importance of this partition of the trade-winds from the two hemispheres has been implicit in Eliot. In describing the passage of Typhoons of the China Seas into the Indian area, the position of this partition has been found very useful by Doraiswamy Iyer³ who has described its position from month to month.

The weather in the tropics needs three air masses—Equatorial Maritime air (Em.), Far-Eastern Transitional or Mixed air (Tr.) and Tropical Continental (Tc.) or Tropical Continental-Maritime air (Tcm.). In several papers, these air masses have been described and their properties developed.⁴

During the northern summer Em. has a southerly component; the Tr. may have components from both north and south according to the geographical position and the Tc. is from W. or W.N.W. All these three air masses are essential, and without any one of them a monsoon depression, a tropical cyclonic storm or a tropical depression cannot form in the strict sense.⁵

The main criterion of drawing the I.T.F. is the direction of the wind. It separates at some places Em. and Tr. and at others Em. and Tc. or Tcm. The partition between Em., which

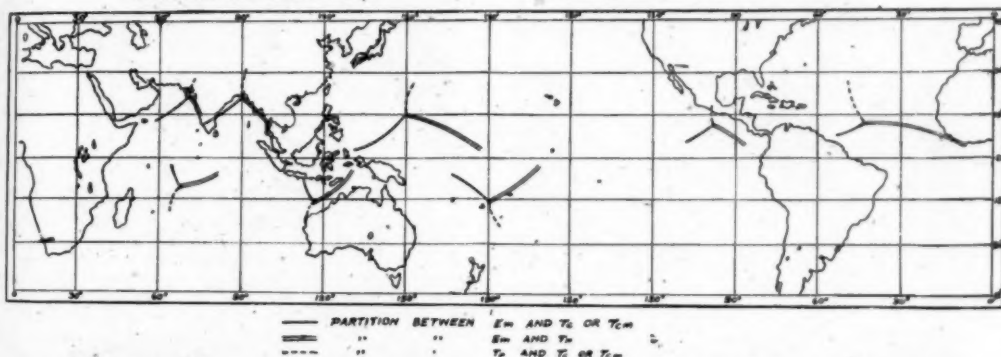
can be made easily unstable, and the hot, almost-saturated, more stable Tr. can show clouds, weather and squalls over a wide stretch. In the partition of Em. and Tc., it may show a few thundershowers or even a scatter of only dry thunderstorms. Between different portions of the I.T.F., there would be distinct differences and the utility for a forecaster also would not be equally satisfactory. With three air masses which go to determine

and Fisharoty, "Evidence of three air masses from temperatures aloft in Tropical Cyclones" (in Press). —, "Abnormally Dry and Wet Western disturbances over N. India" (in Press). —, "Air Mass interpretation of Sen's Vortex method of Weather Forecasting", (in Press). 5. —, *Curr. Sci.*, 1947, 16, 14. 6. Gibbs, *Synoptic Studies in Australian Met.* 7. Malurkar, *Occasional Distant Weather Information and Forecasting* (in Press).

PARTITION LINES IN THE TROPICS

NORTHERN HEMISPHERE JUNE

SOUTHERN HEMISPHERE DECEMBER



tropical weather, it is hardly possible to represent the semi-stationary conditions by a single front. Gibbs⁶ tried a compromise by an extra front called "Tropical front" which, when it combined with the I.T.F., indicated tropical depressions or cyclonic storms. It would be only logical to draw partitions of the three air masses over the Tropical belt as an idealised condition. An active outbreak of the various air masses across these fronts (particularly Em.) would be favourable for unsettled conditions and for development later of a tropical cyclonic storm or monsoon depression.

The available climatic information has been used, and the partitions for the months of June and December have been drawn on a single diagram of the Tropical belt. The partitions in the northern hemisphere represent the conditions in June, while the partitions in the southern hemisphere represent the conditions in December. As tropical weather comes from the east,⁷ the map is drawn with the Pacific Ocean in the middle.

The fairly strong circulation south of the equator in the Atlantic and the Eastern Pacific Oceans, and the extension of the seasonal highs to within a few degrees of the equator prevent any partition lines being drawn. In other words, tropical cyclonic storms do not form there.

Poona 5,
April 19, 1947.

S. L. MALURKAR.

A MOSAIC DISEASE OF BRINJAL
(*SOLANUM MELONGENA* LINN.)

A MOSAIC disease of brinjal (*Solanum melongena* Linn.) was of fairly widespread occurrence in 1946 at Delhi. The chief symptoms are bright green mosaic mottling and malformation of the leaf (Figs. 1-14) such as puckering and crinkling associated with abnormal and incomplete growth of the lamina; occasionally fine, pale, straw-coloured, concentric, irregularly-shaped rings develop on the leaf. In some cases the midrib or its branches protrude beyond the lamina (Fig. 12), while in others the leaf is completely modified into a filamentous structure. There is considerable reduction in the development of flowers and fruits.

To determine if the disease was graft-transmissible the scion from diseased brinjal was grafted on healthy plants of brinjal, tomato and tobacco, raised in the insect-proof house. Twenty-four grafts on brinjal, fourteen grafts each on tomato and tobacco were made; new growths arising from axillary buds on the stock showed typical symptoms of the disease in all the grafts (Fig. 16).

Inoculation of brinjal, potato, tomato and tobacco plants by rubbing the expressed sap from diseased plants or with insect needles previously dipped in the inoculum failed to transmit the virus.

Myzus persicae Sulz. and *Empoasca devastans* Dist. were commonly observed on diseased brinjal plants. Two methods were employed to determine if the disease was transmitted by the agency of these insects.

(i) They were transferred directly from a badly affected plant to healthy brinjal, potato, tomato and tobacco plants raised in the insect-proof house.

1. S. Petterssen, "Weather Analysis and Forecasting," 1940, pp. 270 and 272. 2. H. C. Willett "Descriptive Meteorology," 1944, pp. 192-93. 3. *Mem. Ind. Met. Dep.*, 26, p. 98 (Discussion) and references to Elliot. 4. Malurkar, "Forecasting Weather in and near India" released Nov. 1945, p. 34 *et seq.*; and p. 87 *et seq.* Malurkar

- (ii) They were introduced in a microcage and allowed to feed on a diseased plant for a period of 24 hours and then liberated on healthy plants raised in the insect-proof house.

Each of these plants was covered with a muslin cage.

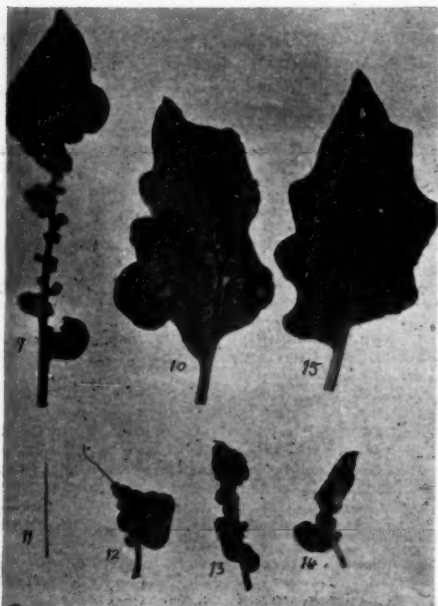
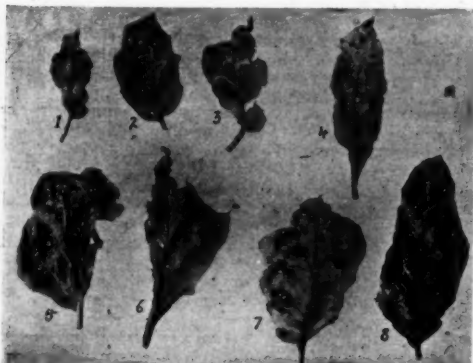


FIG. 1-14. Various types of malformation in the leaves of brinjal badly affected by mosaic disease.

FIG. 15. a young healthy leaf.

All the brinjal and tomato plants on which *E. devastans* were liberated after feeding on diseased plants showed typical symptoms of the disease in 24 to 37 days, while the potato and tobacco plants remained free from the disease; all the four hosts on which *M. persicae* were

liberated after they were fed on diseased plants remained healthy. Control plants were free from the disease.



FIG. 16. A graft with healthy stock of tomato and diseased scion from a badly affected brinjal plant; a, point at which the diseased scion was grafted.

Two virus diseases of brinjal have been reported from Rumania the symptoms of which are different from those observed in Delhi; Savulescu *et al.*¹ described the disease as partial chlorosis causing mottling and dwarfing of the leaves while Alexandri² observed a severe mosaic with yellow interveinal lesions. In the second case the basal leaves of mature plants are the first to show the disease symptoms which spread from the base upwards. Alexandri succeeded in transmitting the virus mechanically and suspected the aphid *Myzus persicae* to be the probable vector.

Insect transmission experiments show that the jassid *E. devastans* can transfer the disease from brinjal to brinjal or tomato.

Experiments on host-range of the virus and transmission of the disease by seed are in progress.

Thanks are due to the Imperial Entomologist for identifying the insects.

Division of Mycology
and Plant Pathology,
Indian Agricultural Research
Institute, New Delhi. S. P. RAYCHAUDHURI.
March 26, 1947.

1. Savulescu, Sandu-ville, Rayss and Alexandri-
Int. Ctr. Agron. et Romanici, 1934, 12, 93. 2. Alex,
andri, *Hommage au Professeur E. C. Teodorescu*,
Bucharest, 1937, 12.

A MOSAIC DISEASE OF *VIGNA CATJANG* WALP.

In October 1942, some plants of *Vigna catjang* Walp. grown on the Agricultural College Farm, Poona, exhibited mosaic symptoms. Under controlled conditions in the glasshouse, the virus could be transferred to healthy plants by inoculation of the sap.

The symptom of the disease in the field is green mosaic. The leaves are malformed and reduced in size, and the dark green areas are interspersed in the light green (Fig. 1). At a later stage of development, the disease becomes severe, and the leaves show chlorosis with small green areas dispersed over their surface. In the glasshouse, severe chlorosis of the leaves does not manifest itself on inoculated plants. Diseased plants bear only a few pods, which are small and show broad stripes of light and dark green colour on their surface. Such pods contain a few seeds each.



FIG. 1. Leaf of *Vigna catjang* affected by mosaic.

Transmission.—The virus is sap-transmissible and infection is rendered much easier by the addition of 600-mesh fine carborundum to the inoculum.

In transmission tests with *Aphis gossypii* Glover, *A. medicaginis* Koch. and thrips, which are commonly found feeding upon *Vigna catjang* Walp., *A. gossypii* and thrips failed to transmit the virus, whilst *A. medicaginis* transmitted it to about 36 per cent. of the plants colonised with the infective adults of this species.

About four per cent. of the commercial seed of *Vigna catjang* produced infected seedlings when grown under controlled conditions in the glasshouse.

Dilution end-point.—The dilution end-point of the virus in crude sap lies between 1:50,000 and 1:10,000.

Thermal inactivation.—The virus withstands exposure for ten minutes at 85°C., but is inactivated at 90°C.

Resistance to ageing.—Infectivity of the virus was lost after fifteen days at laboratory temperature (24°C.), but the virus was still active after nine days.

Host range.—Besides *Vigna catjang*, the virus infects *Vigna sinensis*, *V. sesquipedalis*, *Phaseolus lantanus* and *Canavalia ensiformis*. Several

other leguminous plants and *Nicotiana tabacum*, *N. glutinosa* and *Zinnia elegans* were not infected when inoculated with the virus.

McLean¹ has reported a mosaic disease of cowpeas (*Vigna sinensis*), and Snyder² has described a similar disease of asparagus bean (*Vigna sesquipedalis*). Both these diseases resemble catjang mosaic described in this note, as regards the symptoms produced by them on their hosts, the mode of transmission by sap, by seed and by aphid, and the restricted host range, but they show a marked difference from the latter in respect of the physical properties. Accordingly, catjang mosaic virus is considered distinct from cowpeas and asparagus bean mosaic viruses. Vasudeva³ has also described a mosaic disease of *Vigna catjang* (Punjab cowpea type 1), but he did not investigate its physical properties or its host range. He has given no information either on the transmission of the virus by seed or by insects. Similarly, Dale⁴ has described a mosaic disease of *Vigna unguiculata* L., but he has not studied its transmission by insects or by seed, nor has he described the physical properties of the virus. In these circumstances it is not known whether these two latter investigators were dealing with the virus described in this note.

This work is being carried out under a scheme financed by the Indian Council of Agricultural Research.

S. P. CAPOOR.
P. M. VARMA.
B. N. UPPAL.

College of Agriculture,
Poona.
April 10, 1947.

¹ McLean, D. M., *Phytopath.*, 1941, **31**, 420. ² Snyder, W. C., *Ibid.*, 1942, **32**, 518. ³ Vasudeva, R. S., *Indian Jour. Agric. Sci.*, 1943, **12**, 281. ⁴ Dale, W. T., *Trop. Agriculture*, 1943, **20**, 228.

STICK-LAC AS ILLUSTRATED IN 1567

GARCIA DA HORTA, Physician to the Portuguese Governor of India, published a work, *Colloquios dos Simples e Drogas*, at Goa in 1563. It was translated into Latin by C. Clusius, with the title *Aromaticum et Simplicium* and printed at Antwerp in 1567. The Latin translation contained three illustrations of stick-lac which were absent in the original.

Unfortunately the majority of workers on lac even to this day believe that there is only one species of lac insect; so, for them, the question does not arise as to the identification of the specimen illustrated by Garcia-Clusius. All along the western coast, and therefore also in Goa, it is only *Lakshadia communis* which occurs. Garcia writes, "Here in Goa a boy brought me a branch of a tree which the Deccanis call Ber (*Zizyphus*) . . . it bears (but) little lac." Probably Garcia had his illustrations made from this material, the first he ever saw in the natural condition. But Fig. 1 shows the twig without any thorns, which should be present on *Zizyphus*. However, within the short length shown in Fig. 1, they may be absent. At the top of Fig. 1 the encrustation from either side does not fuse; such an intervening space is typical of *L. communis*.

Fig. 2 is reproduced natural size with an arrow added, showing a piece of extra lac encrustation at the top of Fig. 2. Clusius does not explain his illustrations, nor has he numbered or lettered them; the figures serve more or less like decorations. The original drawings were possibly made by an artist, rather than by Garcia himself, which explains the anomaly in the picture (Fig. 2).

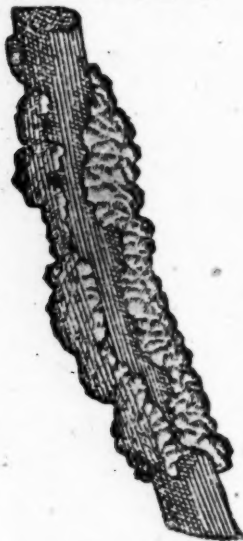


FIG 1



FIG. 2

Biochemical Laboratory,
Osmania University,
Hyderabad (Dn.),
April 16, 1947.

S. MAHDIHASSAN.

HEAT TREATMENT OF GODOWNS

RAHMAN¹ recommends 'superheating' for disinfecting empty godowns, but Pruthi and Singh² speak only of super-heating of grains and not of godowns. In the course of a trial in a godown in Bangalore, the writer experienced some serious reactions due probably to breathing in of carbon monoxide. This note is intended to caution workers, that in undertaking such work, protective devices must be employed.

Two bags of infested grains were spread in a corner away from the fire in a terraced room of 1,952 cubic feet. A fire was started at 9-30 a.m. with 30 lbs. of charcoal. The temperature of the room was recorded every half-hour.

Time	Temperature (° F.)
9-30	80°
10-0	85°
10-30	99°
11-0	104°
11-30	110°
12-0	110°
12-30	120°

(After 12-30 p.m., for reasons noted below, the room could not be entered into.)

At 12-30 p.m. the remaining charcoal was piled on the fire and the room sealed. It was opened two days later, and examination of the grain showed that all species infesting it, viz., Calandra, Tribolium, Rhizopertha and Bruchids, were unaffected by the treatment, and were alive and active. 8 lb. of unburnt charcoal were recovered from the dead fire.

The main reason for the treatment proving ineffective against the insects in this experiment is obviously that the final temperature attained was probably not much more than 120° F. against 152° F. stated as necessary by Rahman. The experiment, when compared with Rahman's, also shows that the final temperature rather than the extent of rise determines the lethal effect on insects.

The writer had no protection when he entered the room for a few minutes every half-hour, and experienced certain disturbing symptoms due probably to taking in of carbon monoxide. These symptoms began at 11-30 a.m., about a minute after entering the room. There developed a sudden dizzy feeling in the head, a violent thumping of the heart and lightness in the limbs with intense perspiration all over; managed to reach the door with unsteady steps and slithered down in a semi-conscious condition outside. In the subsequent half-hours, these symptoms came on immediately on entering the room; in addition, light-headedness and a violent shaking of limbs were also experienced. After 12-30 p.m., it became impossible to get into the room. It took about three hours of rest in fresh air for these symptoms to wear off, though general weakness continued throughout the day.

This experience could have been avoided if mechanical devices of some kind (such as a suitable respirator, gas-mask, automatic temperature recorder, etc.) had been employed to render the operation entirely safe. Such protection, though probably implied is not mentioned by Rahman. If super-heating is undertaken as a regular method for disinfecting godowns, it is essential to be equipped with protective devices.

My grateful acknowledgments are due to Mr. B. Krishnamurti, Entomologist to the Government of Mysore, for valuable suggestions in writing this note.

Entomological Laboratory,
Department of Agriculture,
Bangalore,
April 22, 1947.

D. SESHAGIRI RAO.

1. Rahman Khan, A., *Indian J. Agri. Sc.*, 1942, 12, 564. 2. Pruthi, H. S., and Mohan Singh, *Imp. Council of Agr. Res. misc. bull.*, 1943, 57, 34.

A GIBBERELLA BLIGHT OF RYE HITHERTO UNRECORDED FROM INDIA

A SEVERE blight of rye (*Secale cereale* L.) ears was observed for the first time in the Upper Shillong Farm, Assam, in August 1946. The characteristic symptoms are confined to the heads of the host plant. On the heads the

blight may attack at any point, usually affecting and confining itself to only one spikelet, or later spread to other spikelets if conditions are favourable.

The first indication of infection consists of water-soaked areas, slightly brown in colour on the glumes. As the disease progresses the affected areas dry out and take on a ripened appearance. If the infection spreads into the rachis at the base of the spikelet and completely girdles it the portion of the head above this infected region will die and dry up even if it is not directly invaded by the fungus. After a while a cottony fungus growth, slightly pinkish in colour, appears on the dead surface. This growth becomes evident first at the point of infection but later may spread farther over the infected area. Conidia develop on this growth, and with age the pink tint turns to a darker salmon colour. The pinkish conidial masses are more apt to form at the bases of the spikelets where moisture is held for a longer time.

In the blighted heads the grains themselves are frequently invaded resulting in light weight, shrivelled kernels.

The pinkish coating of fungus growth occurring on the surface of diseased parts was found to consist of abundant conidia on microscopic examination. These conidia are long, slender, curved, septate, typical of the genus, *Fusarium*. The spores range in size from $35-75 \times 4-5-5 \mu$ with the great majority coming within a size-range of $45-65 \times 4-2-5-5 \mu$. Most of them are 5-septate with occasional spores having as few as 3 or as many as 6 or 7 septa (Fig. 2).

On dead blighted heads the perithecia occur as small, black bodies either singly or in groups. They rest on the surface of the host or may be more or less imbedded in the mycelial crust where conidia have been produced. They are ovoid to subconical in shape and measure $150-250 \times 100-250 \mu$. The asci may number over a hundred to the perithecium and each ascus contains 8 ascospores. The ascospores are fusiform, slightly curved, mostly 3-septate and measure $20-30 \times 3-75-4-25 \mu$ (Fig. 3).

The fungus was identified as *Gibberella saubinetii* (Mont.) Sacc. This fungus is known to cause scab of cereals in Europe, America, Australia and Great Britain, but so far it had not been known to occur in India. This communication thus records the first report of the occurrence of the fungus in India.

The specimen has been kept in the *Herb. Crypt. Ind. Orient.*, Imperial Agricultural Research Institute, New Delhi, and in the Herbarium of the Plant Pathological Laboratory, Sylhet (S. Chowdhury, No. 237).

Plant Pathological Laboratory,
Sylhet, Assam,
March 30, 1947.

S. CHOWDHURY.

INDIA'S VITAMIN WEALTH

INDIA abounds in material that contain various vitamins. One such is *Myrobalans* (*Embllica officinalis*, "Nellikai" in Tamil). These fruits contain quantities of vitamin C—a valuable protective food. During the second world war the Nutrition Research Laboratories at Coonoor (South India) were manufacturing tablets from these fruits for the use of the Military. At that time the utilization of these fruits was so much that in certain places there occurred a famine of the local fruit. I have used these tablets with profit. As its need for Military purposes is now non-existent its manufacture has been stopped at Coonoor. Our doctors now prescribe vitamin C as medicine in the form of very costly imported material like "Redoxon". It is a pity that the utilization of one of our indigenous products has thus come to an abrupt end and to the advantage of foreign manufacturers.

Thyagarayanagar,
Madras,
May 6, 1947.

T. S. VENKATRAMAN.

THE DOUBTFUL OCCURRENCE OF A WAX-SPLITTING ENZYME

WHILE fat-splitting enzymes, the lipases, are known from animal, plant and even bacterial sources, wax, on the contrary, is apparently immune to a similar digestion. However there has been a solitary record by Sulc¹ who reports a wax-splitting enzyme in the frothy secretion of a spittle insect, *Aphrophora salicis*. He calls this new enzyme Cerotinase which is supposed to give rise to Cerotinic acid. The term Cerotinase gives rise to a confusion with Carotinase, the enzyme which hydrolyses Carotin. Even apart from this the proper designation should be Cerase according to the substrate upon which the enzyme acts, Cera being wax in Latin.

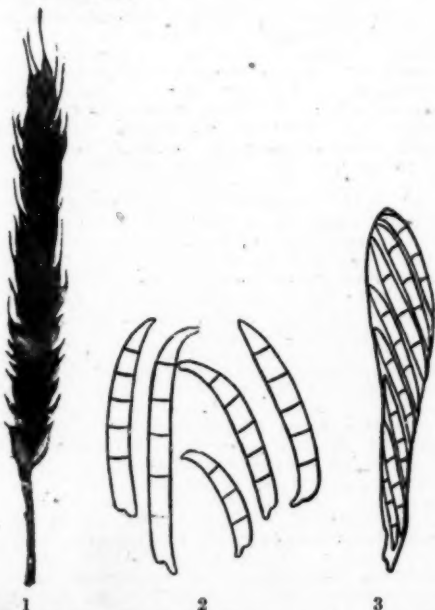


FIG. 1. Symptoms of the disease
FIG. 2. Conidia
FIG. 3. Ascus with ascospores

The so-called spittle is usually contaminated with saprophytic micro-organisms, and Sulc tried to get it in as pure a condition as possible. He collected some larvæ of *A. salicis* in their third stage and allowed them to starve overnight. Early next morning they were placed on the branch of a willow tree where they produced sufficient quantity of fresh spittle within the short period of an hour.

A portion of the spittle was used to prove the absence of lipase by the usual technique. Milk, as natural emulsion of fat, was used as substrate; litmus was used as indicator for showing any acidity that may arise on the hydrolysis of butter. Sulc found the spittle naturally alkaline so that litmus became blue and did not need any additional alkalinity which is necessary for the action of lipase. The test for lipase was negative.

For testing Cerase two test tubes were used. One contained the alkaline spittle with litmus, the other had in addition wax as mere chips. The technique was as primitive as it could be imagined, for wax was not offered to the enzyme in the form of a fine emulsion. Nevertheless the action was as rapid as it could be desired, for within 5 to 10 minutes the tube with wax became red. This has been interpreted as due to the action of Cerotinic acid. Now this higher fatty acid is insoluble in water so the explanation cannot hold.

Another weak point in Sulc's paper is the species of insect he studied. He identified it as *A. salicis* from larvæ which can thus leave us in doubt. When we consider the probabilities of meeting with *A. salicis* and *A. alni* those in favour of the latter are far more. In 1910 when Sulc² reported on symbiosis in a spittle insect it was *A. alni* and not the rarer species *A. salicis*. In 1912 Buchner³ illustrated a larva of a spittle insect which I first thought he left unidentified⁴ but I have subsequently corrected my mistake, as follows. Buchner identifies his specimen as *A. salicis* but it ought to be *A. alni*, being the more common species. In his thesis of 1912 Buchner³ gives cell inclusions which he repeats in his subsequent studies of 1925, this time rightly identifying the insect as *A. alni* but without correcting his previous mistake; compare his Fig. 6, Plate 11 of 1912 with Fig. 9c on p. 112 of his *Memoir* of 1925. Very probably Sulc also investigated the more common insect *A. alni*.

Since spittle is excreted only by larvæ I wanted to be sure of the species which supplied it. I have previously shown that species can be differentiated by the symbiotes they possess. This has been established in the case of yeast-like micro-organisms. It also applies to the bacterial symbiotes but sometimes cultural methods have to be employed to show the specificity of symbiosis. However *A. salicis* and *A. alni* contain bacteria which differ morphologically, as is being shown in another publication.⁵ Having convinced myself of the material I was investigating I tried to repeat Sulc's simple experiments with the spittle from both the insects but with negative results. I also used cultures of symbiotes from these two species and again no Cerase was found.

Sulc also mentions the presence of Cerase in the wax-moth *Galleria melonella*. I had

occasion to study enemies of wax-producing coccids and also predaceous caterpillars that feed on the lac insect. I find lac and wax is excreted by these caterpillars and the wax-moth caterpillar feeds on the larvæ of the bee rather than on the wax of the honeycomb. At least this is true of the enemies of the wax coccids.

The existence of Cerase has been implicitly indicated by workers on leprosy. With Chaulmoogra oil injections serum lipase increases and this has been assumed to hydrolyse the waxy lipid envelope of the leprosy germ. Enzymes are very specific. The increased lipase activity is due to the injection of oil and can be brought about by injecting any oil, be it Chaulmoogra or any other, either in normal subjects or in leprosy patients. Increased lipase activity, contrary to such assumptions, is not indicative of any proper prognosis of the disease.

Biochemical Laboratory,
Research Institute,
Osmania University,
Hyderabad (Dn.),
April 4, 1947.

S. MAHDIHASSAN.

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THE OCCURRENCE OF TERMITES AT KRUSADAI ISLAND

DURING a brief stay at the Biological Station at Krusadai Island in the Gulf of Mannar, the author noticed termite tunnels along the wood-work of the windows in the laboratory and collected a number of workers. However, during the few nights spent there, no alate forms were obtained, but a few of these which had fallen previously (probably the day before) into a glass container, were preserved. Dr. Gardner, Forest Entomologist, Dehra Dun, has kindly identified them to belong to *Coptotermes ceylonicus* Holmgren. The material of the tunnel appeared from a microscopic examination as well as by rough chemical tests, to consist of a fairly large percentage of organic material, the rest being chiefly of calcareous matter belonging to the lagoon deposits of the coral island. A cursory examination of the surroundings did not reveal any other indications of the termite nest. Nevertheless the occurrence of the termites arguing the presence of the nest on the island is of considerable interest because of the isolation of the island. As Dr. Gardner observes, it is possible that honeymoon couples may have been borne thither across the arm of the sea from the Pamban mainland by wind currents; nevertheless, their having tended to their first brood, without ready-made workers in situ, on the island, is a feature of interest. As those who have been visiting the island from time to time would have noticed, the flora and fauna (especially of the insects) are being added to at a rate which well merits investigation. Further, the invasion, if not deliberate introduction, of insects which can keep the termites in check

must interest the officers in charge of the Biological Station, besides affording scope for experimental studies in control of this pest.

University Zoology Laboratory,
Triplicane, Madras, C. P. GNANAMUTHU.
April 25, 1947.

EFFECT OF DIFFERENT GASES ON PROTOZOAL ACTIVITY AND PURIFICATION OF SEWAGE

FOLLOWING the development of the Activated Sludge Process by Fowler and his associates, there was considerable amount of controversy regarding the actual mechanism of purification. Fowler and his associates emphasised the importance of intensive aeration, but other workers laid stress on mechanical agitation. Some methods of purification have also been developed on the latter principle though they do not altogether exclude the presence of air. The importance of air was finally recognised, and during recent years, the role of protozoa as the organisms mainly responsible for the purification is finding general acceptance.

While investigating the role of different species of protozoa in sewage purification,¹⁻⁹ some interesting observations on the effect of differ-

with H_2S , laboratory gas, N_2 and CO_2 , the clarification of sewage was adversely affected. These gases being highly injurious to the life and activity of the protozoa, the organisms became inactive and died. The death of the protozoa caused a steady increase in the organic matter content (i.e., the permanganate-reducing capacity) of the supernatants as determined after removal of the gases; this was confirmed by the experiments carried out without the addition of the protozoan inoculum to the sewage.

The observations made six hours after treatment with the gases on the protozoa, and oxidation changes in the sewage samples are given in Table I.

Considerable amount of attention has been devoted to the study of the different methods of applying air to sewage, the aerating value of various gases and the relative importance of oxygen and stirring.¹⁰ The air which is blown into the activated sludge tank has been generally considered to (a) keep the sludge in suspension, (b) maintain aerobic conditions, and (c) stir up the mixture, bringing fresh liquor into contact with the sludge. It has not been possible to say which of these factors determines the critical air requirement. In the

TABLE I
Effect of different gases on protozoal activity and oxidation changes in sewage
(Results of chemical analysis expressed as parts per 100,000) *

Sewage suspensions* containing the protozoa (<i>Epistylis</i> sp.) treated with	Microscopical observations on the condition of the protozoa	6 hours after treatment with the gases			
		Quality of the supernatants			
		Appearance	Oxygen absorbed from potassium permanganate in 3 mins.	4 hrs.	Nitrite (N)
1. Air	Extremely active	Clear	0.64	1.52	0.040
2. Oxygen	"	"	0.56	1.52	0.044
3. Carbon dioxide	Inactive or dead	Turbid	1.76	3.40	Nil
4. Nitrogen	"	Very turbid	2.68	4.32	"
5. The laboratory gas	"	"	3.52	5.56	"
6. Hydrogen sulphide	"	Extremely "	—	—	"

* The composition of sewage in each case at the start of the experiment was as follows:—

Oxygen absorbed from potassium permanganate in 3 minutes 1.96 (as parts per 100,000)
4 hours 3.28 (" ")

Nitrite (N) Nil

** The figures for oxygen absorption in this case were by far the highest.

ent gases on the protozoal activity and attendant changes in the medium were made. The results of one set of experiments with *Epistylis* sp. (one of the most important forms of protozoa in sewage purification) are briefly described below.

Each of a number of conical flasks (250 c.c.) containing 150 c.c. of heat-sterilised sewage was inoculated with 15 c.c. of a fresh culture of the protozoa, washed in ammonia-free distilled water. Nearly equal volumes of air, O_2 , CO_2 , N_2 , the laboratory gas (mixture of kerosene gas and producer gas) and H_2S , were bubbled through the suspensions in the flasks by adjusting the size and number (per second) of the gas bubbles. The progress of purification of the samples was studied by examining at intervals the condition of the protozoa and the sludges as also the quality of the supernatants.

Even during the first two hours of treatment

light of our observations it appears that the more important function of aeration is the supply of oxygen for the aerobic organisms which bring about the purification of sewage.

The authors thank Dr. G. J. Fowler for his valuable criticism.

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Dept. of Biochemistry,
Indian Institute of Science, M. I. GURBAXANI,
Bangalore, V. SUBRAHMANYAN.
March 27, 1947.

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CHROMOSOME STUDIES IN THE GENUS *IPOMAEA*

THE genus *Ipomaea* includes several economic plants and many garden favourites. King and Bamford (1927) have published a list of chromosome numbers of several species in this genus. This list does not include some species of *Ipomaea*, for example, *I. pulchella* Roth., *I. carnea* Jacq., *I. reptans* Poir. Kano (1929) has reported the haploid number of *I. batatas* Lamk. as 42 and King and Bamford, however, estimate the diploid number to be 90.

Both mitosis and meiosis were studied. Roots were obtained from the cuttings. All the materials were fixed in CrAF and stained by iron-alum-haematoxylin. As the Figs. 1-3 show,



FIG. 1.



FIG. 2



FIG. 3

Mitotic metaphase plates 1. *I. carnea*. $2n=30$ 2. *I. reptans*. $2n=30$ 3. *I. pulchella*. $2n=30$

I. carnea, *I. pulchella*, *I. reptans* have $2n, 30$. The diploid number of *I. batatas* is 90. In *I. batatas* somatic pairing was found among the chromosomes in pairs in majority of plates.

PLATE I.—Meiotic II metaphase in *I. batatas*, $n=45$

In meiosis, stages from diplotene to anaphase were available for study. Fifteen bivalents were formed in both *I. carnea* and *I. pulchella*. The diplotene bivalents showed both terminal and interstitial chiasmata. In *I. carnea*, secondary association among the bivalents was noticed in majority of plates. The haploid number of *I. batatas* was found to be 45. (Plate I).

The plants under study showed some abnormal features. 'Syndiploid' cells or two- to three-nucleate p.m.c. were observed in *I. carnea* and *I. pulchella*. 'Syndiploidy' has been previously reported by several workers in *Lactuca* (Gates and Rees, 1921), *Prunus* (Darlington, 1928), *Brassica* (Karpechenko, 1927). Darlington (1937) considers this phenomenon as a racial or genetic character.

I wish to thank late Dr. V. K. Badami, ph.D. (Cantab.), for initiating the work, and Mr. S. Sampath for bringing it to completion.

College of Agricultural Research,
Benares Hindu University,
Benares, N. SATYANARAYANA RAO.
March 21, 1947.

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STUDIES IN VITRO OF SOME SULPHANILAMIDE DERIVATIVES

TREFOUEL *et al.*¹ observed that N^4 -sulphanilamide acetic acid is a good bacteriostat in *vitro*. In view of this Bami, Iyer, and Guha²⁻⁵ synthesised a number of aliphatic esters and acids substituted at N^4 -position of sulphanilamide as well as certain alkylene bis-sulphanilamide and their N^1 - and N^4 -substituted derivatives.

The bacteriostatic activity of some of these compounds was determined both by the Oxford cup method with *staphylococcus aureus* and by the turbidimetric method with both *saphylococcus aureus* and *streptococcus hemolyticus*.

All the compounds mentioned in the table were soluble in water and had a maximum pH of about 8.

Compounds No. 13 and 14 are a few of the antimalarial drugs of the sulphanilamide-bis-guanide type while compound No. 15 is a salt of Paludrine.⁶

The table shows that in general the compounds are equally effective against both types of organisms. Compounds No. 1, 11 and 14 however, inhibit *streptococcus hemolyticus* at a concentration much less than is required for *staphylococcus aureus*.

Our thanks are due to Prof. P. C. Guha, Dr. K. P. Menon for their kind interest and help during the course of this investigation.

Bacteriostatic activities of some sulphanilamide derivatives

Compound	Maximum dilution which is active against	
	Staphylococcus aureus	Strepto hemolyticus
1. Ethylene-bis-N ⁴ -sulphanilamide ²	1:1000	1:5000
2. Methylene-bis-N ⁴ -sulphanilamide ²	1:2000	1:2000
3. Trimethylene-bis-N ⁴ -sulphanilamide ²	1:1000	1:1000
4. Ethylene-bis-N ⁴ -(N ⁴ heptyl-sulphanilamide) ²	1:1000	1:1000
5. Ethylene-bis-N ⁴ -(N ¹ acetyl-sulphanilamide) ³	1:1000	1:1000
6. N ⁴ -Sulphanilamido-acetic acid ^{1, 4}	1:1000	1:1000
7. N ⁴ -Sulphanilamido-acetic acid ^{1, 4}	1:2000	1:2000
8. N ⁴ -Sulphanilamido-propionic ester ⁴	1:10000	1:1000
9. N ⁴ -Sulphanilamido-butyric ester ⁴	1:1000	1:1000
10. N ⁴ -Sulphanilamido-malonic ester ⁴	1:1000	1:1000
11. N ⁴ -Sulphanilamido-phenyl acetic ester ⁴	1:1000	1:5000
12. N ⁴ -Sulphanilamido-phenyl acetic acid ⁴	1:1000	1:1000
13. N ¹ -p-chlorophenyl-N ⁵ -p-sulphonamido-phenyl biguanide hydrochloride	1:1000	1:1000
14. N ¹ -p-chlorophenyl-N ⁵ -p-phenyl sulphonamido-2-thiazole-biguanide hydrochloride	1:1000	1:5000
15. N ¹ -p-chlorophenyl-N ⁵ -isopropyl-biguanide acetate (Paludrine) ⁶	1:1000	1:1000

Pharmacology Section,
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April 19, 1947.

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ENDOPOLYPLOIDY IN YEASTS

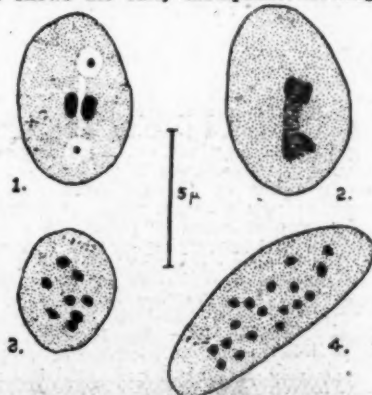
ARE fermenting cells comparable to actively secreting glandular cells? As far back as 1910, Wager and Peniston¹ suggested such a comparison. And yet, the importance of the above suggestion does not appear to have been realized by later workers. Anyone conversant with the cytology of glandular secretion (Bowen²) would be aware that secretory cells take their origin from embryonic replacement cells. Gland cells themselves fall into two distinct categories. In the "holocrine" type, the cells die after a single secretory cycle, while in the "merocrine" type, they pass through several secretory cycles before death supervenes. It has been known for the past one decade that merocrine cells show various degrees of endopolyploidy (White³). Some of the remarkable advances in our knowledge of the genetics of *Drosophila* are based on the study of polytene chromosomes in the endopolyploid nuclei of the salivary gland cells. Resting nuclei of gland cells may or may not show polytene chromosomes. In fact, in many cases their endopolyploid constitution could only be inferred. Cancer cells possess an inherent impulse for rapid multiplication, and it appears that polytene chromosomes could be observed during stages of division (Bieseke⁴). Gland cells show only occasional metaphases and the earlier controversy regarding the behaviour of the nucleus in gland cells (Kater⁵) is reminiscent of a similar state of affairs in yeasts (Nagel,⁶ Lindgren⁷). To investigate the question whether the failure of gland cells to divide mitotically is the result of their highly endopolyploid constitution Brues and Marble⁸ and Bieseke⁴ stu-

died the cytology of regenerating livers. This was under the belief that partial removal should accelerate mitotic division and bring to light the chromosomes and thus afford evidence regarding the constitution of the nuclei of glandular cells.

If fermenting yeast cells are endopolyploid, then it should be possible to demonstrate the same by experiments planned on similar lines. Just as surgical removal accelerates mitotic division in the liver, replacement of the spent wort with fresh medium in fermenting cultures produces the same effect.

Therefore, tubes of wort were inoculated with the brewery strain Sc. 9 and after the lapse of five days the spent medium was poured out and replaced with the same quantity of fresh medium. The contents of the tubes were centrifuged and smeared at five-minute intervals commencing from 40 minutes after the addition of fresh medium. The descriptions are based on Feulgen preparations.⁹

The mitotic cycle during the aerobic phase has already been described for this strain.^{10,11} Fig. 1 shows the early metaphase showing the



two chromosomes, the centrioles with their centrospheres and the developing spindle. In Fig. 2 is shown the anaphase.

An examination of the preparations of fermenting cells induced to multiply by addition of fresh medium shows dying cells as well as healthy ones. In healthy cells various division pictures are present. There are rare clusters of cells showing the typical stages seen in the aerobic phase. The majority show varying degrees of polyploidy. In Figs. 2 and 3 two such cells showing different numbers of chromosomes in the cytoplasm are illustrated. The stages of division of such cells are irregular. Often they are abortive. Regular meta- and anaphase stages are rare and the chromosomes generally do not get segregated during division into equal complements. The bud often gets only a much smaller number. There is also a fair percentage of cells showing amitosis-like figures. These are probably the highly endopolyploid cells whose nuclei are unable to resolve themselves completely into their component chromosomes in spite of the very favourable environmental conditions. The stimulus afforded by the nutriment and the availability of dissolved oxygen leads to abortive attempts at division as evidenced by the amitosis-like figures observed.

By their multiplication the embryonic cells in glands replace those that die after a varying number of secretory cycles. It appears likely that a similar state of affairs occurs in fermenting cultures also, where a small percentage seem to retain their power of normal vegetative reproduction (Slator¹²). The products of division of fermenting cells have no genetical future at all unless of course a small percentage go through a series of reduction divisions as in the multiple complex cells of *Culex* (Grell¹³).

Two workers from the same laboratory have recently presented differing interpretations of the structure of the yeast cell (Nagel,⁶ Lindegren⁷). While Miss Nagel has found it necessary to coin new terms to denote the various structures in the yeast cell, Lindegren seems to have changed his previous opinion¹⁴ and basing his conclusions on the casual suggestion of Rafalko¹⁵ now believes that yeasts have conventional Feulgen positive chromosomes. He has yet to prove that the homologies of the structures seen by him are identical with those observed by Rafalko.

In view of the varying behaviour of the nuclei during aerobic growth and fermentation, it is not surprising that there is such a remarkable diversity of opinion. In fact one has to expect it. It would be evident that the differing interpretations are not due to the technique of fixation and staining as assumed by Nagel but in the handling of material for cytological investigations. The cytological behaviour of glandular cells in animals are interpreted in terms of changes from normal in response to specialization and no generalization is attempted based on results on glandular cells alone. Yet, generalizations on the nuclear behaviour in yeasts appear to be based on the tacit assumption that there is no difference between a growing culture and a fermenting one. The fact that the yeast is versatile and possesses oxidative and fermentative abilities was forgotten. That the cytology of a dividing cell is entirely different from that of a cell in active secretion was ignored. The tremendous importance of the above distinction can be

imagined when it is realized that an actively growing culture would become a fermenting one, when there is not enough dissolved oxygen in the medium for respiration. Once this simple distinction is made, it would be evident that the cytology of yeasts is in no way different from that of higher organisms.

I am very grateful to Sir J. C. Ghosh for his active interest and encouragement and to the Council of the National Institute of Sciences (India) for the award of an Imperial Chemical Industries Research Fellowship.

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AN UNUSUALLY EFFECTIVE CONTROL OF A PEST BY A PARASITE

THE two species of *Epilachna* beetles, *Epilachna dodecastigma* Muls. and *E. vigintioctopunctata* Fab., are serious pests of the brinjal plant in the United Provinces as also in other parts of India. For several years past, the seasonal incidence of these two pests has been under routine observation at Cawnpore, but no sudden changes in their population, as a result of attack by natural enemies, had been noticed. Early in September 1946, however, a heavy parasitisation of the *Epilachna* grubs by *Pleurotropis* sp.* (*Eulophidae-Chalcidoidea*) was observed in a brinjal field, about half an acre in area at Cawnpore. During the second, third and fourth weeks of September, large numbers of the adult parasites emerged from about 300 *Epilachna* grubs kept in the laboratory for rearing. Simultaneous observations in the field showed that towards the end of the month, practically every grub had been parasitised and the pest brought under complete control. This quick work by *Pleurotropis* sp. against its *Epilachna* hosts is worthy of record. During the period of the field observations, the average maximum and minimum temperatures were 92.7° F. and 77.9° F. respectively and the average relative humidity 84.7 per cent.

The genus *Pleurotropis* has over two dozen species distributed in nearly all parts of the world. The three identified species so far known in India, viz., *P. detritus* Gahan, *P. epilachnae* Rohwer and *P. foveolatus* Crawford¹, as also some unidentified species, were all reported from Bangalore, Coimbatore or Cochin (South India). The occurrence of a

species of *Pleurotropis* at Cawnpore, therefore, is the first record for Northern India.

While most of the species of *Pleurotropis* have been known to parasitise phytophagous larvae of Coleoptera, Lepidoptera, Diptera and Hymenoptera in various parts of the world several of them have been recorded also as secondary or hyper and even tertiary parasites.^{2,3,4} It appears that at least one species, *P. parvulus* Ferr., has been successfully employed in the biological control of pests—in Fiji against *Promecotheca reichei* Baly and in New Guinea against *P. papuana* Csiki, both coconut leaf miners (see *Rev. App. Ent.*, A, 1940, 28 (2), 50-51; 28 (5), 230, and previous connected references).

In view of the fact that the species of *Pleurotropis* have a wide range of hosts and appear to flourish under fairly cold and humid conditions, there is some promise of their being useful against *Epilachna* beetles, damaging brinjal and other cultivated plants in the hills of the United Provinces and other areas.

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* We are thankful to Mr. M. S. Mani, St. John's College, Agra, for the generic identification of this parasite.

THE MODE OF ACTION OF ACETYLCHOLINE ON UNSTRIATED MUSCLE

SINGH^{1,2,3,4} has suggested that one of the ways in which drugs act is by sensitising the muscle to ions in the solution, the mechanism of this sensitisation being an increase in permeability. This view is supported by the fact, that sometimes unstriated muscle,⁵ and striated muscle,⁶ do not relax on the withdrawal of the stimulant; the contraction, therefore, must have been caused by some substance, other than the original stimulant.⁷

Action of acetylcholine.—Acetylcholine produces either twitches or tonic contraction in frog muscle. Twitches are produced by small concentrations (1 in 10⁵), or at higher temperatures (30°C.). Tonic contractions are produced by large concentrations or at lower temperatures. If acetylcholine produces twitches, then in the presence of subliminal concentrations of substances that usually produce tonic contraction, such as potassium, nitrate, iodide, thiocyanate, it may produce tonic contraction.

The above tonic contraction may be due either to acetylcholine or the contracture-producing substance, one making the muscle sensitive to the other. That it can be due to acetylcholine is shown by the fact that the muscle relaxes on withdrawal of the drug, though the relaxation may be slow showing that the other substance may also be involved. That it can be due to the other substance, is shown by the fact that the muscle does not relax on with-

drawal of acetylcholine, but does so on withdrawal of the contracture-producing substance. Thus if the concentration of potassium in the saline is raised to a value just sufficient to cause a small contraction and acetylcholine added, then, instead of twitches a tonic contraction results. On withdrawal of acetylcholine the muscle does not relax, but does so on withdrawal of potassium (Fig. 1).

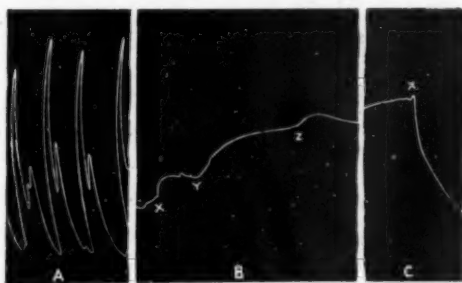


FIG. 1. Frog stomach muscle.

A. Contraction with acetylcholine in saline.
B. Same in the presence of excess of potassium (0.016008 M); potassium added at X, acetylcholine added at Y and withdrawn at Z; no relaxation.
C. Potassium withdrawn at X; note relaxation.

Action of other substances.—In *Mytilus* muscle, similar results are produced if it is immersed in a barium-rich solution just insufficient to cause a contraction. Contraction will now occur if adrenaline or acetylcholine are added, or if electric current is passed, or the muscle is given a sudden stretch or release; this contraction will subside on withdrawal of barium. This shows that electric current, drugs and sudden stretch or release produce some similar effect. This effect is probably responsible for slow relaxation when the muscle is stimulated by contracture-producing substances.

Discussion.—The presence of a substance around the muscle fibres is not sufficient to produce excitation. According to current views, acetylcholine would produce depolarisation of the membrane and so increase the permeability. This would result in entrance of potassium ions into the muscle fibres, so that for excitation, movement of ions appears necessary, as electric current would also produce a movement of ions; this might produce an increase in the concentration of ions in an outer zone.³

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REVIEWS

Dating the Past: An Introduction to Geochronology. By Frederick E. Zeuner. (Methuen & Co., Ltd., London), 1946. Pp. viii + 444. Pls. 24 and 103 diagrams. Price 30s.

The term Geochronology was first applied to absolute dating in years, and the author has now extended its definition to include relative dating as well. It covers a wide field, and the very diverse methods of chronology developed by archaeologists, stratigraphic geologists, palaeontologists, palaeobotanists and physicists have been welded together into one connected theme. The book is based on courses of lectures organised by the author as Professor of Environmental Archaeology at the University of London, and the major portion of the book has been written with special regard to archaeology. The author pleads for a new orientation as to methods in archaeology and questions the practice now in vogue, namely, that of using palaeolithic implements as zone-fossils. "This practice", he states, "may work well in many cases, but the successes are apt to obscure the fact that the cart is being put before the horse, the precise geological age of the industries being assumed as known (often on very flimsy or even incorrectly interpreted evidence), and this assumption being used to determine the age of the deposit containing the industry". The author, well known for his work on Pleistocene climatology, stresses the need for basing archaeological dating on climatic evidences. "I would suggest that the environmental and palaeoclimatic aspects of archaeological stratigraphy should be granted greater prominence during the excavation. Much has been done in this respect in recent years, but more remains to be done, especially under the supervision of workers trained in this particular line of work."

In Part I of the book, the author gives a comprehensive account of tree-ring analysis which has been successfully applied to the dating of pre-historic sites in America. Summarising the results so far obtained, the author states, "In spite of the limited applicability of tree-ring counting to archaeological dating a reliable calendar has been established for the dwelling sites and cultural phases of the south-western United States, covering 1,500 years. This is a spectacular success indeed".

Part II deals with the technique and results of varve-analysis as developed in Sweden by Baron Gerard de Geer and his school. This represents the first method in the absolute chronology of dating in years. Prof. Zeuner thinks that the results are reliable within certain limits, and is sceptical regarding the application of the method in long-distance correlation. A long chapter is devoted to the micro-palaeobotanical method of pollen analysis, a technique which in recent years has yielded valuable results and established itself as a reliable method of dating sediments apparently regarded as unfossiliferous.

Part III discusses the climatic chronology of the Pleistocene, the evidence for which is mostly palaeobotanical. The chapter is a summary of the author's work on the climatic phases of the Ice-age. Other interesting topics included are: the Astronomical theory of the Ice Age and the chronology of early man and his cultures.

Part IV is a detailed account of the palaeontological and radio-active methods of dating the rocks of the earth's crust. There is also an interesting chapter on the time-factor in evolution and one notes the absence of any reference diastrophism as a compelling factor in organic evolution.

The book is a thorough and masterly account of a highly involved subject bristling with apparent anomalies and difficulties of interpretation. The author has made an exhaustive search of literature (as many as 650 references are cited in the bibliographies) and this feature makes it valuable as a source-book. Archaeology (particularly in India) has too long been in the hands of workers ignorant of geological methods and concepts, and the present book demonstrates that the chief field of application of geological chronology is pre-historic archaeology and human palaeontology. 'Dating the past' has been a long neglected branch of geological science in India, and only recently has a full appreciation of its importance as a fundamental research which must precede all economic aspects of geology been realised.

S. R. N. RAO.

A First Course in Mathematical Statistics. By C. E. Weatherburn, M.A., D.Sc., Professor of Mathematics in the University of Western Australia. (Cambridge University Press), 1946. Pp. xv + 271. Price 15s. net.

The present trend in text-book writing in statistics reveals two schools: the first school shuns anything mathematical and gives the statistical tools as so many magic formulæ to be used in specified cases. This is perhaps necessary for the layman or for those applied Statisticians who do not possess the rudiments of mathematics. The other school treats statistics as a branch of mathematics and leaves the physical background untouched. Both schools suffer from the defect that none meets the practical requirements of the applied statisticians. In statistics, as in other applied sciences, the knowledge of the tools are as much necessary as that of the ground on which they will be used. Nevertheless, the theory of tool-making as an abstract science is very useful to those engineers who want to use tools efficiently in their jobs, so knowledge of the mathematical theory of statistics is useful to the statisticians who want to use statistics efficiently in their investigation.

The object and scope of the book is clearly stated by the author in the preface in the fol-

lowing line. "The subject treated in the following pages is best described not as statistical methods but as statistical mathematics or the *Mathematical Foundation of the interpretation of statistical data*." But as this book is aimed to be a first course in Mathematical Statistics, the author confines himself to that portion of the subject as is intelligible to "the students with an average mathematical equipment including an ordinary knowledge of the Integral Calculus."

The content of the book is briefly given as follows. The first chapter gives the fundamental idea of frequency distributions and the concept of moments (including first moment and variance). This is followed in the next chapter by the fundamentals of the theory of probability and probability distributions. Here also are considered the important theorems of Tchebycheff and Bernoulli and the concept of convergence in probability. The moment-generating functions (characteristic function) and cumulative functions are also introduced here. The third chapter deals with the important univariate distributions of Bernoulli, Poisson and Gauss-Laplace (normal). The next two chapters develop the theory of Bivariate distributions, theory of regression (linear and curved), normal equations for fitting regression lines, theory of correlation, correlation ratio, intra-class correlation, etc. The idea of sampling and standard errors of statistics in large samples are discussed in the next two chapters (Chapters VI & VII). Before dealing with the theory of small samples and the exact sampling distribution of statistics, the author deals with the general problems of the Beta and Gamma distributions in detail in Chapter VIII. The next two chapters deal with the small sample theory and the uses of the 't' Z (or F) statistics. Their distributions are considered as the applications of the Beta and Gamma distributions. In the eleventh chapter the author considers the problems of Analysis of Variance and Covariance and considers the randomised block and Latin square arrangements, simple factorial arrangement. The tests of significance of coefficients of correlation, coefficient of regression, the correlation ratio, linearity of the regression line, etc., are also considered. The book closes with the XII Chapter where problems of distribution in more than two variates are considered with problems of partial regression, multiple correlation, etc.

The book is quite well written and is fairly complete within the limits set by the author. The book will be useful to beginners as an introduction to the mathematics of statistics, and may serve as a help-book to students appearing in the degree examination in statistics in an Indian University. The total omission of the empirical system of curves such as the Pearsonian system or the Kram-Charlier system is a defect of the book which the reviewer hopes will be removed in the next edition of the book. The elaborate exposition of the moments and cumulants loses much of its usefulness due to this. The knowledge of these curves to the practical and theoretical statistician is essential, and these could have found a place in the book without infringing on the mathematical limits set by the author. We end

with an unimportant remark. In page 186, it is stated that the distribution of $t = \frac{(x-\mu)}{\sigma} \sqrt{n}$ was found by W. S. Gosset. But Mr. Gosset found the distribution of a statistic Z (which is $\sqrt{n-1}t$) which is slightly different from t. The t was introduced by Prof. Fisher.

A. BHATTACHARYYA.

Calculating Machines. By D. R. Hartree. (Cambridge University Press), 1947. Pp. 40. Price 2sh.

This booklet is based on the inaugural lecture given by Prof. Hartree after his appointment as the Plummer Professor of Mathematical Physics in the University of Cambridge. The author who had the privilege of handling and working with one of the modern calculating machines set up at the University of Pennsylvania, known as the ENIAC, gives in this little book a brief, critical and authoritative account of the different types of calculating machines and of the ENIAC in particular and points out their limitations and prospective developments.

Equipment for carrying out numerical calculations can be divided into two main classes. They are distinguished by the terms 'analogue' and 'digital' machines. Analogue ones operate by translating numbers into physical quantities of which the numbers are measures and finally measuring some physical quantity to give the result; examples are the slide-rule, planimeter, differential analyser, etc. On the other hand, the digital machines handle numbers directly in digital form usually counting discrete events of some kind; examples are the ordinary Brunsviga and Marchant calculating machines. After referring to the two types of machines described above and to the recent developments, the author points out that digital machines which use the technique of electronic circuits hold out most promise for the future because of their high speed.

The only calculating machine yet completed and operating using electronic circuits as the computing elements is the ENIAC (Electronic Numerical Integrator and Calculator) developed and built by the Moore School of Engineering at the University of Pennsylvania. It is essentially a multi-register machine operating by counting electrical pulses by electronic counting circuits and works directly in the scale of ten to ten figure capacity. The main parts of the machine are accumulators (registers), function tables, card reader, card puncher and master-programmer. The master-programmer is the most important part of the machine through which the repetition of a computing sequence and changes from one computing sequence to another are organised. The ENIAC comprises 18,000 valves and takes a power of 150 kw while in operation. The ENIAC carries out an addition in a fifth of a millisecond and a multiplication in less than three milliseconds. It has a high-speed memory capacity of 20 numbers. This according to the author is the most severe limitation of the ENIAC. In spite of this fact, the speed of operation of the ENIAC is of the order of a thousand times faster than anything else at present available. The power and speed of the

ENIAC could be judged from the fact that non-linear differential equations with two-point boundary conditions are successfully solved in a few minutes.

While pointing out that the use of a machine is no substitute for the thought of organising computations but only for the labour of carrying them out, the author emphasizes the importance of getting the "machine's-eye-view" of the problem to be solved and of giving the machine appropriate instructions. Even if some of the organisation of the calculations is done by the machine, as is possible in future developments, the operator will still have to think out the sequence of operating instructions which will enable the machine to do this organisation. Discussing about prospective developments in the technique of calculating machines, the author says that machines having a high-speed memory capacity of over 1,000 figures and using much less equipment and power than the ENIAC are under development and when completed they will certainly have considerable reactions not only on the strategy of large-scale numerical work but also on the formulation of some classes of problems in mathematical physics.

R. S. K.

Surveying—Theory and Practice. By John Clayton Tracy. (John Wiley & Sons, New York; Chapman & Hall, London), 1947. Pp. xxxiv + 1,279, illustrated. Price \$7.50.

This is a revised and greatly enlarged edition of the author's pocket manual, *Plane Surveying*, first published in 1907. The book is divided into four main parts, namely, Field Work, Office Work, Surveying Instruments and Standards and Surveys. Each part is again subdivided into several chapters, bearing on individual aspects of survey work.

Every experienced Surveyor will heartily endorse the remarks of the author in the Preface to the book, viz., "The theory of Surveying can be learned in College, but the art of Surveying can be acquired only by long experience". This exhaustive treatise will be very useful in assisting the Surveyor to gain such experience in the correct way. Examples of actual detailed surveys carried out in practice are given with exhaustive notes and clear explanations as to the various observations recorded in the Field Book. These impress the reader with the importance of giving attention even to the minutest details in order to make a good job of any survey work carried out in practice.

The chapters on "Methods of Locating Details", "Working up Field Notes Preparatory to Plotting", "Finishing the Map", "Aerial Photographic Surveys", etc., are some examples, where details required are elucidated in a simple and clear way. In many instances, the author deals with different methods of conducting any one particular kind of survey. This gives the student the necessary background to choose the appropriate method to be adopted in any particular situation.

The treatise will be very useful as a textbook for students in learning Survey, no less than to practising Surveyors. The 23 tables given at the end of the book and those that

are interposed in the body of the book are valuable adjuncts and enhance the value of the volume as a book of reference.

K. B. K. R.

The Chemistry of Acetylenic Compounds—Volume I. The Acetylenic Alcohols. By A. W. Johnson. (Edward Arnold & Co., London), 1946. Pp. xx + 394. 35/- net.

The present volume is a very welcome addition to the literature in organic chemistry. The subject-matter is divided into three parts according to the number of hydroxyl groups and acetylenic bonds contained in the molecule. Each of these parts has again been subdivided into eight sections thereby giving a connected, collected account exhaustively reviewed up to September 1945. Tabulating of the known acetylenic alcohols and their physical constants and the indexing are properly and helpfully done.

The chemistry of compounds containing acetylenic linkages has, until very recently, been considered to be only of academic interest. The rapid development of the chemistry of polyenes has resulted in more attention being paid to acetylenic compounds. A number of improved preparatory methods for the hydrocarbons, carbinols and glycols are now available. A particularly active form of sodamide in liquid ammonia gives a distinct advantage over the old sodamide method since the sodio-compounds undergo smooth substitution reactions. Large-scale production of carbinols and glycols can be effected by employing potassium hydroxide and calcium carbide. The isomerism of acetylenes into allenes and conjugated dienes, and the anionotropic rearrangements of acetylenic carbinols derived from $\alpha\beta$ -unsaturated carbonyl compounds are receiving greater attention. Alkylation of phenols using acetylenic compounds has resulted in the fairly ready synthesis of compounds closely allied to natural products. Vitamin E analogues have been synthesised by the condensation of alkylated hydro-quinones containing at least one free position in the nucleus with tertiary acetylenic carbinols. Divinylacetylenes have also been employed for the alkylation of phenols. The chlorination of the hydrocarbons, carbinols and glycols have received attention. The chemistry of the rubenes and their ability to absorb oxygen on irradiation are topics of interest. The application of the reactions of acetylenic carbinols to synthetic problems in the field of the sex hormones has proved to be of fundamental importance. An interesting synthesis of vitamin A methyl ether has been reported whereby the Grignard derivative of ethynylcarbinol of β -ionone is condensed with 1-chloro-2-methyl-4-methoxy-2-butene and the resulting monoether of the acetylenic glycol partially reduced over a palladium catalyst. Rearrangement and dehydration in acetic acid in the presence of a trace of *p*-toluene sulphonc acid gave vitamin A methyl ether.

The reviewer has read the book with interest and profit and feels sure that the volume is indispensable to workers in the field as well as to those who wish to acquire a thorough knowledge of the subject.

K. N. M.

Introduction to Silicate Industries. By H. N. Bose. (Ceramic Publishing House, Church Road, Bhagalpur, India), 1947. Pp. viii + 84. Price Rs. 7-8-0.

The author is already fairly well known for his works on *Modern Pottery Manufacture*, *Pottery Management* and other technical books. The book under review, as the title indicates, is a broad outline of major industries which utilise silica for their raw material. Thus the manufacture of glass, enamel, pottery, limes, cements and refractories are described in the present volume. Each chapter is logically developed with a brief history, raw materials required, methods and machineries of production and properties of the products. The author has purposely avoided technical language and formulae in order that the book may be useful for the general reader. The volume is sure to be of interest for non-technical industrialists, parliamentarians, civilians and general science students. The book is well printed and got up, but contains a number of printing errors which could have been avoided. This may be rectified when the next edition is issued. The inclusion of at least a subject index would have added to the usefulness of the book.

K. S. R.

Rothamsted Experimental Station—Report for the War Years 1939-1945.

An impressive document covering about 270 pages represents the consolidated report of the work done at Rothamsted during the War years. The period has witnessed the Centenary Celebrations (1943), expansion of buildings and activities and the inevitable change of personnel. The retirement of Sir John Russell after over thirty years of meritorious service and succession by Dr. W. G. Ogg; the passing away of Messrs. D. W. Cutler and E. H. Richards, both of whom have left their marks on their respective branches; the creation (or reconstitution) of Crop Physiology, Plant Pathology and Plant Biochemistry are noteworthy events of the period. During the War, the Station also accommodated a number of other departments from London and elsewhere, and these, in turn, have left their mark on the work of the laboratories.

The total number of publications during the period runs to some hundreds. Among the contributions, special mention may be made of the discovery of common-salt as a fertiliser for sugar-beet, the increased output of sugar being almost equivalent to the weight of salt applied; the development of silico-phosphates as fertilisers; the demonstration of the value of molybdenum as an important trace element; the study of mutants formed as the result of soil inoculation with soil bacteria; the finding of 2:4 dichlorophenoxyacetic acid as a useful weed-killer; extensive work on the nature and properties of plant viruses, their identity as nucleo-proteins, the development of serological methods for their detection and study of interrelation between vectors and hosts; the comparative studies on pyrethrum extracts and DDT for plant protection; influence of proto-

zoa, by their selective feeding, on the soil bacteria; effect of poison gases on crops, grains and other stored goods; level of feeding dairy cows on milk production; the foul brood disease of bees which has been controlled; and the experiments on deep (7-8") and shallow (3-4") ploughing which have not revealed much difference between the two except in the case of certain crops. Many of the findings are of practical value and may soon lead to extensive application in different parts of the world.

The results with composts and sewage sludges are rather disappointing. The observation that digested sludges form better manures than raw sludges may not be generally accepted. The advantages of composting refuse with activated sludge was demonstrated in India several years ago.

The publication is a remarkable document in that it shows no visible signs of the difficulties and privations of the War years. Some departments have no doubt spent a good deal of time on special War work, but even these are of ultimate scientific and practical value. Certain departments like Plant Pathology and Entomology seem to have carried on as in normal times, while laboratories in distant parts of the world, which did not even see a black-out, were greatly affected by the war. This type of calm, detached and persistent effort reflects much credit both on the station and its workers.

V. SUBRAHMANYAN.

Biochimica et Biophysica Acta (International Journal of Biochemistry and Biophysics), Vol. 1. (Inter-Science Publishers Inc., New York), 1947. Annual Subscription \$ 9.00.

The publication of international journals in every field of human endeavour is always to be warmly welcomed as one of the effective means for the promotion of international amity and understanding. Pre-war Germany was the pioneer in organising international collaboration in the editing of science journal and the publication of the well-known series of "Hand Buchs". The scene of such activity has now shifted to America which has emerged out of war with enhanced scientific prestige and material resources.

The new Journal covering as it does both Biochemistry and Biophysics is more comprehensive than its contemporaries which specialise in either of the two. The first issue, however, contains papers on Biochemistry only, and covers the fields of Enzymes, proteins and micro-chemical analysis. The papers are presented either in English, French or German, each being followed by a summary in all three languages.

The international representation on the Editorial Board of the Journal could be further reinforced by inviting members from Austrian, German, Asian and Australian countries also. We wish to extend a hearty welcome to the Journal and wish it a progressive and purposeful career. The publishers deserve to be congratulated on their enterprise.

K. S. R.

SCIENCE NOTES AND NEWS

SCIENTIFIC MAN-POWER COMMITTEE

To ensure the proper development and utilisation of India's scientific man-power and resources the Government of India have set up a Scientific Man-Power Committee with the following terms of reference:—

(1) To assess the requirements for different grades of scientific and technical man-power, taking a comprehensive view over a period of the next ten years, of the needs of Government (civil and defence), of teaching and research, and of industry, agriculture, transport, medicine and other fields dependent on the use of scientific and technical man-power.

(2) To make recommendations regarding action to be taken during the next five years to meet these requirements, in particular with reference to:

- (a) the immediate improvement and expansion of facilities for scientific and technical training in Indian universities and special institutions;
- (b) training overseas in scientific and technical subjects;
- (c) the promotion and development of scientific and technical research;
- (d) the utilisation of scientific and technical man-power; and
- (e) the maintenance of a register of scientific and technical personnel to facilitate their utilisation to the best advantage.

The future of industry and defence as well as the large number of development plans and projects which have been prepared or are under preparation depend upon the proper and most effective organisation and utilisation of the scientific man-power and resources available in India. The Scientific Man-Power Committee will survey the problem in all its aspects and recommend policies which should govern the use and development of the country's scientific man-power and resources during the next ten years.

DR. RAJENDRA PRASAD'S APPEAL TO SCIENTISTS

The need on the part of scientists to apply themselves first to matters relating to the welfare of the common man was stressed by Dr. Rajendra Prasad, Food Member, Government of India, when he addressed the members of the Indian Institute of Science, on the 9th May.

The primary need of the common man as also of everybody was food, and as such, research institutes such as the Indian Institute of Science should first concern themselves with research in food production. It was no good for research workers concentrating themselves in any work if it meant ignoring the needs of their villagers. Their work should have a bearing on the needs of the villagers and they should evolve formulæ by which more and better food would be grown.

INDIAN AGRICULTURAL RESEARCH INSTITUTE

The following students of the Indian Agricultural Research Institute, New Delhi, have

been awarded the Diploma of the Institute (Assoc.I.A.R.I.) after completion in September 1946 of two-year P.G. Course:—

Agricultural Botany and Plant Breeding

(1) Narendralal Dhawan: "Interspecific hybridization in *Sesamum* L." (2) S. Basharat Ali Shah: "Colchicine-induced polyploidy in different varieties of chillies (*Capsicum annum*)". (3) V. Ramamurthy: "Pt. I.—Studies in the seed-coat anatomy of Brassica species." "Pt. II.—Studies on colchicine-induced polyploidy in some Imperial Pusa types of *Sesamum orientale* L." (4) Choudhry Mohd. Sharif Sardar Khan: "Influence of late sowings of wheat on yield and variation in plant characters". (5) Yogendra Mohan Upadhyaya: "Variability and the role of natural selection in wheat varietal mixtures and hybrid generations". (6) Shyam Narain Sharma: "Effect of temperature on the development of wheat grain".

Agricultural Chemistry and Soil Science

(7) Khubo Gianchand Tejwani: "Effect of nitrogenous and phosphatic fertilizers on soil fertility and crop composition when legumes or either included in or excluded from the rotation (a Lysimeter study)".

Entomology

(8) Parkash Lal Renghen: "Pt. I.—On the morphology of immature stages of fruit-fly *Dacus cucurbitae* Coq. with short notes on its biology." "Pt. II.—Our present knowledge of the insect pests in India of the important edible fruits of the family Rosaceae". (9) Abdul Maman: "Pt. I.—The Survey of insect pests of dried fruits". "Pt. II.—Biology of the saw-toothed nuts beetle *Oryzophilus mercator* Fauvel, with description and bionomics of one new species of the genus *Statimopoda*". "Pt. III.—Thorough review on the work done on most important pests of dried fruits, with a separate chapter on control measures". (10) Mohammed Mohsin: "Pt. I.—Studies on the role of nutrition in the longevity and fecundity of *Microbracon geleckiae* Astom., a larval parasite of potato tuber moth." "Pt. II.—A review of the work done in the control of the sugarcane moth borer, *Diatraea saccharalis* Fab. by its egg parasite, *Trichogramma minutum* Riley."

Mycology and Plant Pathology

(11) Hari Krishna Saksena: "Studies in the physiology of *Ustilago tritici* (Pers.) Rostrup. causing loose smut of wheat".

Sugarcane Breeding

(12) Obaidullah Jan: "Pt. I.—Sugarcane breeding with special reference to the work done in Coimbatore". "Pt. II.—Some studies on the influence of the size of the sugarcane setts, location of nodes and the depth of planting on the germination, tillering and final stand of the crop". (13) Om Prakash Agarwal: "Pt. I.—The activities relating to the production of Co. canes with special references to the breeding work at Coimbatore". "Pt. II.—Studies on the effect of period factor on growth of sugarcane".

FIRST ANNIVERSARY OF THE GEOLOGY DEPARTMENT, PATNA UNIVERSITY

The First Anniversary of the Geology Department, Patna University was celebrated on the 25th April 1947 in the University premises.

In the premises of the University Library, a geological exhibition was held illustrating the Mineral Industry of the Province. It contained most of the industrial minerals and products of Bihar, e.g., iron, coal, copper, aluminium, ceramics, cement, glass, etc.

The function in the evening was presided over by the Hon'ble Acharya Bhadrinath Varma, Minister for Education for Bihar. A popular lecture illustrated with maps and lantern slides was delivered by W. D. West, Director, Geology Survey of India, on Bihar's Mineral Wealth and Industries.

JOINT EXPEDITION TO THE ANTARCTIC

Leading British Scientists have accepted the general plan for the joint Norwegian-British-Swedish Expedition to the Antarctic.

Mr. L. P. Kirwan, Director of the Royal Geographical Society in London, said that though the bulk of the work is going to be done by Norwegians because the expedition was being conducted under the Norwegian Flag, it had been agreed that a Briton would be Deputy Leader to Major-General Hjalmer Larsen, the Norwegian explorer, who has been the main figure in arranging this joint Antarctic trip.

"We have decided to give financial help to this joint expedition and we expect financial help from the British Government", Mr. Kirwan said. "This will match the help from the Norwegian and Swedish Governments, for the expedition is to cost £100,000."

Mr. Kirwan added that one of the two Catalina flying boats which will be used by General Larsen will be manned completely by British personnel.

GOVERNMENT OVERSEAS SCHOLARSHIPS

One hundred and thirty-six candidates have been selected for the Central Government's Overseas Scholarships this year. These include 86 Hindus, 34 Muslims, 2 Scheduled Castes, 6 Christians, 1 Parsi and 7 Sikhs.

The total number of applications received was 2,497 and 293 were interviewed. Most of the successful candidates will go to U.S.A. or the U.K., though a few will go to the Continent and China as well as the British Dominions. The total of subjects for which candidates have been selected is 83.

COCONUT RESEARCH SCHEME, CEYLON

Dr. T. S. Raghavan, formerly Professor of Botany, Annamalai University, has been appointed Botanist to the Coconut Research Scheme, Ceylon, in place of Dr. W. V. D. Pieris. He has published much work in cytology and cytogenetics. Recently he synthesised a new species of *Sesamum* by hybridisation between *Sesamum orientale* and *S. prostratum*, the sterile hybrid having been artificially rendered fertile through the induction of amphidiploidy. In the hybrid has been incorporated the perennial habit of the prostratum parent.

INDIAN SCIENTISTS TO VISIT BRITAIN

SIR SHANTI SWARUP BHATNAGAR will leave for the United Kingdom in the first week of July to attend the Centenary celebrations of the Chemical Society, London, and the International Congress of Pure and Applied Chemistry, London, to be held in July. Three other Indian scientists—SIR J. C. GHOSH, SIR C. V. RAMAN and SIR K. S. KRISHNAN—are also expected to attend the Centenary celebrations.

Sir Shanti Swarup intends to visit Germany and Switzerland also.

PLAN TO CONSERVE COAL RESOURCES

With a view to drawing up a ten-year programme for conservation of coal resources through scientific process of coal stowing, the Government of India in the Works, Mines and Power Department, have decided to appoint a Committee of Experts consisting of Mr. J. R. Harris, Coal Commissioner, Mr. Nausher Ali, Chairman, Coal Mines Stowing Board, one nominee of the Railway Board having experience in railway transport problems, and the Chief Inspector of Mines.

SOLAR ECLIPSE

On 20th May 1947 scientists studied the total eclipse of the sun at Bocaiuva in Brazil. Many other points on the sun's path, close to this village, were chosen by various expeditions from all over the world.

Various projects had been planned for this eclipse including the testing of new, high-powered photographic instruments as well as scientific confirmation of existing theories of light, magnetism, colour and space. Einstein's relativity theory was studied by several Geophysicists. Brazil's National Observatory which had also organised an expedition in the field and another in the observatory hundreds of miles away from Rio de Janeiro, compared observations from the sun's path and from a varying angle.

Interesting results are expected from these investigations.

WORLD STATISTICAL CONFERENCE

The United States have invited 62 Governments to send delegates to the International Statistical Institute, and the 21 American Republics to send delegates to the first session of the Inter-American Statistical Institute.

These organisations will meet in September. The World Statistical Congress, which is being convened by the U.N. Economic and Social Council, will also meet in Washington at the same time.

The International Statistical Institute has held biennial sessions for more than 60 years at the invitation of various Governments. President Truman, as chief executive of the host nation, has accepted the Honorary Chairmanship of this session.

COONOR PASTEUR INSTITUTE

Dr. N. Veeraraghavan has been appointed to officiate as Director of the Pasteur Institute, Coonoor, in place of Lt.-Col. Ahuja who is transferred to Kasauli as Director of the Central Research Institute.

INDIAN INSTITUTE OF SCIENCE

Mr. M. S. Thacker of Calcutta has been appointed the Head of the Power Engineering Department of the Indian Institute of Science.

UNIVERSITY OF MADRAS

The Registrar invites applications for the post of a Lecturer in Leather Technology on Rs. 210-15-300 plus D.A.; and a Lecturer in Textiles on Rs. 210-15-300 plus D.A., before the 25th of June 1947. Further particulars can be had from the Registrar.

AQUARIUM FOR BOMBAY

Mr. B. G. Kher, Premier of Bombay, laid the Foundation Stone of the "Taraporevala Aquarium" in Bombay on the 9th May. Mr. D. B. Vieaji Taraporevala, after whom the Aquarium is named, donated a sum of Rs. 2,00,000 while the Government of Bombay has contributed Rs. 5,00,000 to meet the cost for the construction.

PHARMACEUTICAL COLLEGE FOR BOMBAY

A sum of three lakhs and one thousand rupees has been donated to the Ahmedabad Education Society for starting a Pharmaceutical College in memory of the late SETH LALLUBHAI MOTILAL.

The Governing Body of the Society has decided to name the College which will be the first of its kind in Bombay Province after SETH LALLUBHAI MOTILAL.

RHODES SCHOLARSHIPS FOR INDIA

Mr. Asim Kumar Datta of Bengal and Mr. Lovraj Kumar of the United Provinces were elected by the Rhodes Trustees to the two Rhodes Scholarships that were allotted to India for the first time last year. Two more of these scholarships have now been advertised in the Press by the Selection Committee for India, presided over by Sir Maurice Gwyer, Vice-Chancellor of the University of Delhi. The scholarships tenable at the University of Oxford, for two, or in certain circumstances three, years are of the annual value of £400 with, subject to certain conditions, a supplementary allowance of £100 per annum.

DEVELOPMENT OF FISHERIES

Dr. Rajendra Prasad, Food Member, Interim Government, laid the Foundation Stone this morning (13th May 1947) of the Hydro-Biological Laboratories at "Fish-lands", Chetput, Madras.

A "Mermaid Fair" had been organised to demonstrate the importance of fish as food and the various experiments that were being carried on by the Fisheries Department. Several stalls had been put up. Fish of various kinds found in the Province, and charts showing their food-value were also exhibited.

THE INTERNATIONAL UNION OF BIOLOGICAL SCIENCES

The International Union of Biological Sciences (sec M. J. Sirks, University of Groningen)

will hold its 9th Assembly in Copenhagen, on July 28, 1947. The meeting will be chiefly concerned with establishing a programme of work for the Union and its Sections for the period 1947-50. The Union will be in a position to arrange, in the near future, for special conferences (limited to ten invited scientists) on timely subjects and Dr. Sirks will welcome suggestions from delegates and other colleagues for such conferences.

THE FIFTH INTERNATIONAL GRASSLAND CONGRESS

(Secretary, C. K. Van Daalen, Bilthoven, Neth.)

The Fifth International Grassland Congress which will be held in the Netherlands, June-July 1949, will be concerned chiefly with grassland problems of regions with a temperate climate. Excursions will be made through the various pasture types represented in the Netherlands. There will be five sections: (1) Soils, Manuring; (2) Genetics, Breeding, Seed prod.; (3) Grassland sociology and ecology, Botanical analyses of grassland; (4) Making, management and utilisation of grassland, Farm organisation questions; (5) Fodder values of pastures, Fodder conservation.

DEVELOPMENT OF MINERALS

An administrative organisation to standardise conditions of mineral development in India and also to exercise Central control over the exploitation of the country's mineral assets will soon be set up by the Government of India.

This organisation, to be known as the Bureau of Mines, will function under the aegis of the Member for Works, Mines and Power of the Government of India.

The scope of this central organisation will include powers to frame rules regarding the terms and conditions of leases, the application of improved mining methods to ensure conservation of mineral assets, control over exports, collection and compilation of statistical returns, encouragement of the domestic utilisation of ores and minerals, and the prosecution of research on mining and fuel.

The Central Government, it is gathered, have decided to form this organisation with a view to formulating a policy of co-ordinated development, conservation and consolidation of India's mineral wealth as well as to provide an effective check to unrestricted exploitation. This Bureau will not only further mineral development within the sphere allotted, but will also assist Provincial and State Governments in such schemes as they might sponsor for the development of their mineral resources.

A well-organised laboratory with the latest and most up-to-date equipment will be attached to this Bureau for fundamental and applied research in mineral development, etc., and other necessary purposes. A department of Public Relations will form part of this organisation, to acquaint the general public with the details of mineral research undertaken by the Bureau.

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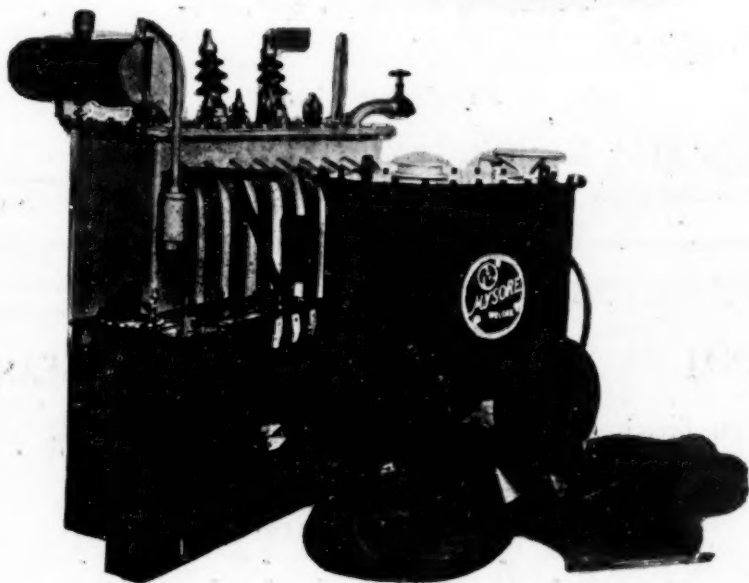


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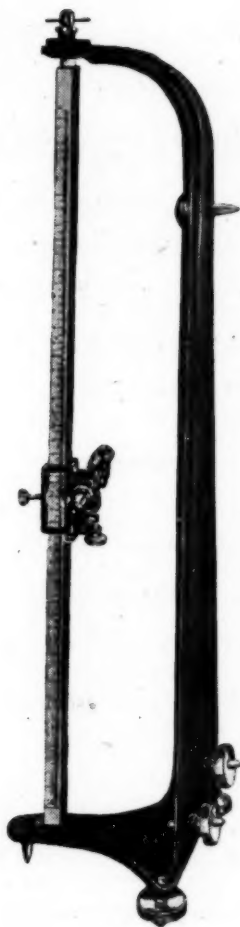
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